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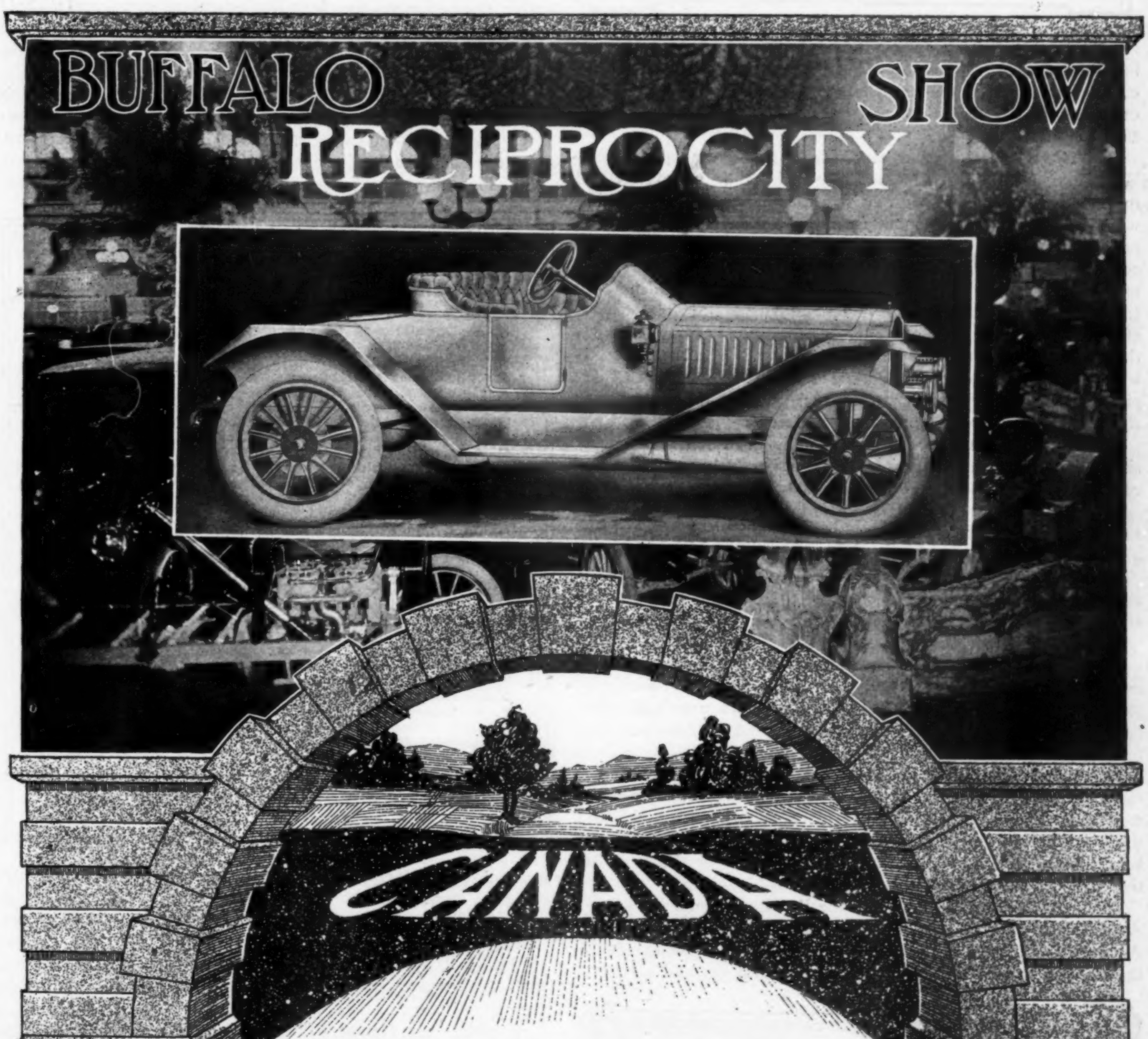
The Automobile



BUFFALO, N. Y., Feb. 6.—In a driving blizzard the doors of the Ninth Annual Automobile Show were opened, and a crowd that broke all Buffalo show records poured into the Arsenal to-night. From the moment Buffalo's Mayor pressed the electric switch that released the bolts and signaled the orchestra to begin playing "My Country 'Tis of Thee," until nearly midnight, a solid throng coursed into the big hall and crowded the aisles to a point where progress was difficult.

The composition of the crowd was similar to all automobile show first nights. Thousands were there for amusement, but most of those who braved the stinging blizzard seemed to have

BUFFALO'S NINTH ANNUAL SHOW

Number of car models exhibited: 204.
Number of makes represented: 60.
Number of firms and companies exhibiting: 57.
Place where show is held: Broadway Arsenal.
Comparative size of show: Fifty per cent. larger than last year.
Decorations: Severely plain, relieved by gorgeous light effects.
Promoters and managers: Buffalo Automobile Trade Association.

more serious business on hand. The number of parties dressed in evening clothes was noteworthy, and the exhibits of such companies as the Pierce-Arrow, Peerless, Packard, Thomas and other higher priced cars attracted the most careful attention of the visitors.

The Arsenal presented a most pleasing interior appearance. While the decorations were severely plain, they were effective to an astonishing degree. From the floor clear to the dome the walls and ceiling were smoothly covered with white cloth, thoroughly fireproofed. The effect lent itself to vastness and the continuous billow of white was unrelieved except for lines of brilliant lights, each blazing with the potence of 250 candlepower. In the center of the ceiling the most gorgeous colored light effect ever seen in Buffalo, if not in the country, was produced through a combination of thousands of small bulbs entwined with flowers. The colors used ranged from deep yellow to soft pink and when the current was turned on even the most blasé show-goer was forced to give the tribute of applause.

The exhibits consist of fifty-six booths in which are shown sixty different makes of cars, totaling 204 models and a rather complete line of automobile accessories of all sorts.

The floor of the Arsenal is divided into eight huge blocks, separated by wide aisles, and around the walls on all four sides a string of exhibits, mostly accessories, are ranged.

No individual decoration was allowed save for parti-colored ribbons which were placed by some of the exhibitors to protect some specially delicate upholstery, and the whole impression created was of exceeding richness and elegant simplicity.

The cars ranged from the smallest runabout and most minute accessory to the great road locomotive of 90-horsepower, capable of carrying nine passengers. The electrics were well represented in all varieties marketed in the Buffalo field and attracted their due amount of attention.

The orchestra is stationed in a stand at the end of the auditorium, high above the floor, where the musicians can be seen as well as heard by everybody in the place. At the street side of the building the executive offices of the management, telephone booths and telegraph office are installed, while at the back is the café and refreshment booths.

The show is being conducted by the Buffalo Automobile Trade Association, whose efforts are endorsed and supported by the Automobile Club of Buffalo. This is the second year in which the present management has undertaken the show, and in point of public interest and completeness of exhibits it stands out distinctly in a class by itself.

The history of the Buffalo show covers nine years. In the early days, back in 1903, a trade association decided to hold a show. It scored a success at the first effort, and for four seasons the dealers conducted the annual display, each succeeding event going a step further in advance as the state of the art and trade developed and spread out. But in 1907 the character of the annual display was greatly enhanced by virtue of the interest taken by the owners of automobiles, and the Automobile Club of Buffalo assumed the management.

The club conducted three very successful shows, but in 1910 the industry had progressed to such a stage that it was no longer deemed advisable for that organization to try to hold the management and the annual show reverted to the trade association. The show last year set a new mark in its line, and this year it is fifty per cent. greater than ever before.

The officers of the Automobile Trade Association are as follows: John J. Gibson, president; George Ostendorf, vice-president; Ralph E. Brown, treasurer; A. W. Meyer, secretary. Directors: Charles F. Monroe, J. A. Cramer and E. E. Denniston.

On Thursday Rochester day will be observed, and three special trains to carry the delegation of visitors from that city have been arranged. In the evening "Society Night" will be marked, and the program will include several added features of entertainment.

A Maxwell "Q" car has been offered as a door prize, and will be awarded to some visitor on the final day of the exhibition.

One interesting feature of the show is the method used in keeping the floors clean. The surface of the floor is covered with white canvas under all the cars, and naturally enough the mud tracked into the Arsenal during such a storm as greeted the opening of the show is bound to leave its marks on such material. Under ordinary circumstances the white canvas would be marred beyond recognition in half an hour, but at the show there is a gang of ten men working constantly with vacuum cleaners which suck up the mud and dust and snow.

The show marks the beginning of a new era in motordom in this part of the country and enthusiasm, optimism and confidence in the future form the basis of a harmony in which both trade and public join.

List of Exhibitors at Buffalo Show

E. E. Denniston & Co.: Bodies, tops and the Denniston Commercial.
Buffalo Overland Co.: Full line of Overland cars.
Joseph Breardt: Auburn.
Automobile Club of Buffalo.
Jaynes Auto Supply Co.: Supplies, tires, etc.
The Kleinhans Co.: Automobile clothing supplies, etc.
George G. Danford & Sons: Atterbury trucks.
E. A. Green: Cole "30."
J. I. Case Threshing Machine Co.: Case.
Albert Poppenberg: Paige-Detroit, Warren-Detroit, Reo and Everitt.
Densmore Co.: Packard.
Ralph E. Brown Motor Co.: Winton.
Babcock Electric Carriage Co.: Babcock electrics.
Brunn Automobile Co.: Peerless, Haynes and Brunn electric.
Franklin Automobile Co. Franklin.
Meyer Carriage & Automobile Co.: Pullman.
Mason B. Hatch: Chalmers, Hupmobile and Hupp-Yeats.
Kane Motor Supply Company: Cadillac.
Pierce Automobile Co.: Pierce-Arrow.
Thomas Motor Co.: Thomas.
Sanderson & Burkhardt: Firestone-Columbus.
Bison Motor Car Co.: Abbott-Detroit and Krit.
F. A. Ballau: Selden, Brush, Jackson.
Centaur Motor Co.: Oakland, Oldsmobile and a line of general accessories.
Buick Motor Co.: Buick passenger and freight lines.
Mitchell Motor Car Co.: Mitchell.
J. A. Cramer: Stoddard-Dayton and Stoddard "20."
Dixon Motor Car Co.: Velie, De Tamble.

SALIENT POINTS OF THE DISPLAY

Typical Buffalo show weather: Blizzard and snow.
Attendance at first night: Larger than ever before.
Vacuum cleaning gang kept canvas flooring spotless.
Thursday will be Rochester Day and Society Night.
Storm tied up surface cars, but could not check attendance.
Show opened on the second by Mayor of Buffalo, who threw an electric switch, drawing door bolts and signalling the orchestra.

The show is co-operative to a certain degree, as the trade association is a stock corporation, the profits coming back to the members in the shape of dividends. A large majority of the exhibitors are members of the trade association.

Canada, "Our Lady of the Snows," is the best foreign customer of the American automobile. Customs figures show that during the last year somewhere near $5,000,000 would represent the value of American automobiles sold in Canada, and that vast figure will be largely exceeded during the current period.

Canada is a great, wealthy, growing, potent field for the sale of motor cars. Its production of wheat and foodstuffs, much in excess of domestic consumption demands, creates a big trade balance in favor of that country and as the money and credit piles up the demand for good, sound automobiles grows more insistent.

In order to take advantage of that market, several manufacturers of medium priced machines have installed assembling plants on Canadian soil, to which the American factories ship rough parts of cars, which are finished and put together under Canadian conditions and are sold without being obliged to pay the 35 per cent. duty imposed on imported automobiles. These Canadian assembling plants of American cars have not thoroughly demonstrated their practicability, and at least one of these enterprises has been abandoned.

But in Canada, just as in the United States or in any other country where the inhabitants have wealth and are progressive, the man who wants a first-rate automobile will have it despite duty or other obstacle. Therefore, the Canadian merchant, professional man, business man or the owner of a big ranch who feels the call of the motor will buy without reference to tariff walls or territorial limits. Thus, the makers of sound automobiles in the United States have been able to work up a fine trade with Canada. But the cars that have been and can be sold in Canada must measure up to a rigid standard, because the Canadian is a conservative buyer and demands value for value. Where these conditions can be met the American manufacturer has found that the market is satisfactory.

Buffalo is the chief center of Canadian distribution. Of course the various companies making typical American cars are represented by agents in the most populous centers in Canada and the business done through that channel represents a large total, but the Canadian territory adjacent to the international boundary and within the sphere of immediate influence of Buffalo is the richest field within the borders of the Dominion.

List of Exhibitors at Buffalo Show

F. A. Sherman & Co.: Inter State.
Co-Operative Motor Car Co.: Stevens-Duryea, Pope-Hartford, Knox and Hudson.
Ford Motor Co.: Ford.
Detroit Electric: Detroit Electric line.
Lewis Engel, Jr.: Cartercar passenger and freight cars.
United Motor Co.: Maxwell, Columbia and Sampson light delivery.
Windson Motor Car Co.: Elmore.
Chisholm Sales Corporation: Locomobile.
American Motor Truck Co.: Trucks.
Iroquois Rubber Co.: Tires and accessories.
Charles E. Miller: General accessories.
Buffalo Maintenance Co.: Grabowsky trucks.
Frey Auto Supply Co.: Speedometers and general accessories.
Polson Manufacturing Co.: Windshields, tops and bumpers.
Alden-Sampson Co.: Trucks.
Robertson-Cataract Co.: Electrical accessories.
Brunn & Co.: Bodies, etc.
Hayes-Schoepflin Co.: Rapid trucks.
Edgar C. Messersmith: Lexington.
Joseph B. Schmidt: Acheson Graphite.
Whiting Motor Car Co.: Whiting.
Frontier Rubber Co.: Tires.
E-M-F Co.: E-M-F and Flanders.
Nerwick Bros.: Schacht line.
H. G. Tanner: Rambler.
Cataract Refining Co.: Lubricants.
Wayne Oil Tank & Pump Co.: Pumps.

WHY THEY WANT RECIPROCITY

Because it would stimulate trade in both countries.
Because the pressure of Canada's food stuffs to market would bring down American cost of living.
Because American machinery would add to Canada's productivity.
Because it would extend the market for American automobiles and prevent the mulcting of Canadian buyers.
Because it would mean more business for both countries and a more equitable basis of trade.

The historic ground lying between the lakes and the Province of Ontario, extending both East and West from the city of Hamilton, constitutes a territory that has proved to be valuable to those sellers of automobiles whose headquarters are in Buffalo.

It is not surprising then that an appreciable section of those who are attending the Ninth Annual Automobile Show this week are Canadians who are bent upon investigating and inspecting the very complete line of cars on display at the Buffalo show.

They do not seem interested in the cheaper, untried makes, but may be found during any session assembled about the exhibits of the most costly and perfect types of cars in the show.

To them the $5,000 automobile is of more interest than the cars that sell for less than $1,000, but the center of attention as far as they are concerned seems to be somewhere in between those limits.

Everybody in Buffalo is anxious for the adoption of a reciprocal trade arrangement between the United States and Canada. Canada needs the broader market afforded by the United States for her wheat and food products, and the United States needs the influence of the Canadian supply to bring down the cost of living to a reasonable level. While this country still figures as the world's greatest exporter of food and material from which clothing may be made, the influx of the Northern wheat and lumber is sorely needed to force an adjustment of values.

On the other hand, the development of Canada could not be helped more vigorously than by raising the restrictions that now exist barring the free importation of American machinery and manufactured products into the Dominion. The stimulation to trade that would follow such an arrangement between the two governments would be double acting and self-propelling. The Canadian by the use of American machinery would increase his productivity in appreciable measure, with all that such a condition must mean to American consumers and at the same time the fact that the product of American factories would have a wider market means simply that the field of industry in the United States would be vastly broadened and improved. This signifies additional employment of labor and outlines a condition with which no fault can be found.

As far as the automobile industry is concerned, reciprocity

CANADA AS AN AUTOMOBILE MARKET

The Dominion is a great, wealthy, growing State.
It has the money to buy the cars and wants them.
Despite the 35 per cent. tariff, the imports of American automobiles amount to $5,000,000 a year.
It has a favorable trade balance which must be settled either in merchandise or money.
United States needs the wheat and produce and Canada needs our factory products.
This country would rather settle in goods than in money, and the same may be said for Canada.

Where the Thomas cars were at home. One of Buffalo's own makes of automobiles

with Canada holds out an alluring prospect. Under present conditions the fact that American exports of automobiles amount to about $5,000,000 a year speaks volumes for the sterling worth of the cars, but the tariff imposes an obstacle that might appear at first glance to be prohibitory. The idea of a car listing at $3,000 in the city of Buffalo, where prices of living are on a level with other American localities and much higher than they are in Canada, and the identical car listing at $4,000 in Hamilton, or Fort Erie, or Toronto, presents an incongruous spectacle. As a matter of fact, the dollar of the Canadian is more valuable than the dollar of Uncle Sam, because the Canadian's dollar may be exchanged for more goods of a given quality in Canada than the American dollar can buy in the United States. This is particularly true of the necessities of life. Therefore, the Canadian who wants to buy an American car listed in Buffalo at $3,000 must spend $4,000, that will buy more goods, dollar for dollar, for the same automobile.

Under the circumstances the motor trade has had to struggle mightily to gain a market, but as has been recounted it has succeeded in doing so to the extent of $5,000,000 a year despite the tariff. The chief sufferers are the Canadian buyers, who have been unreasonably mulcted; the American manufacturers, whose market has been restricted, and the dealers in automobiles adjacent to the Canadian border.

The workings of the tariff have been particularly vicious with respect to those cars that are assembled in Canada. It has been found that instead of broadening the market and furnishing the goods at such a figure that the Canadian buyer might gain the advantage of the difference between the American list price and that price with the tariff of 35 per cent. added, the market price of the assembled cars was pushed up until it rested just under the sum of the factory price in America and the Canadian tariff. This effectually shuts off competition in those lines, because the assembled cars sell for about $100 per car less than the American cars imported complete.

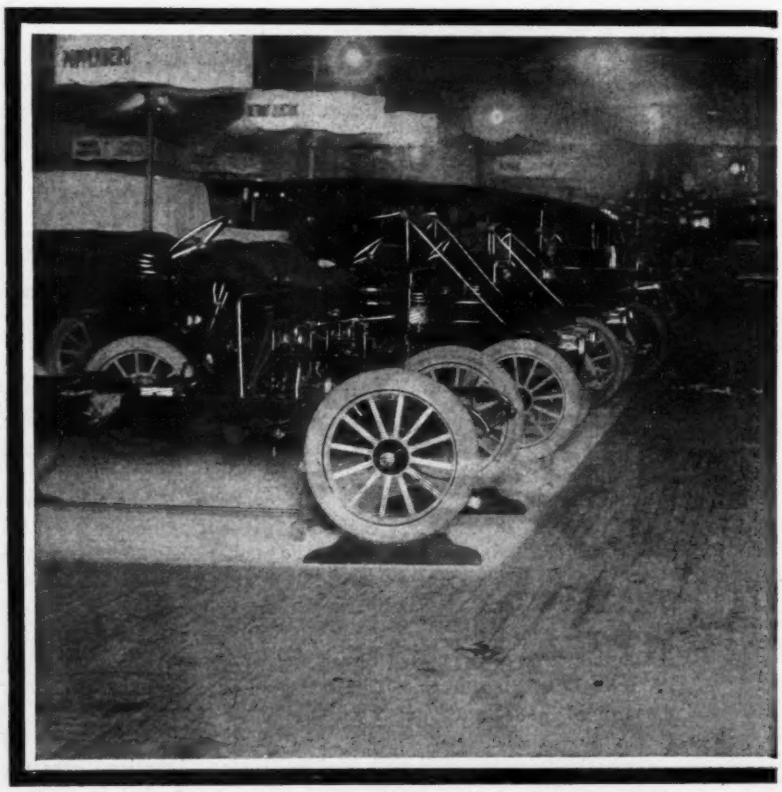
Thus the Canadian buyer is given the chance to secure a moderate priced car, say one costing about $1,000 in the United States, for $1,250, and all competition in that line is killed by the tariff. Such a condition is the one to be corrected by the treaty which is now being considered in the legislatures of the two countries.

Buffalo is specially attentive and the automobile manufacturers and dealers of the Bison City are perhaps more interested than any other element of trade on this side of the line. The Canadians also appear to be quite as anxious, and the latest advices from Washington form a distinct topic of conversation throughout the border section of both countries.

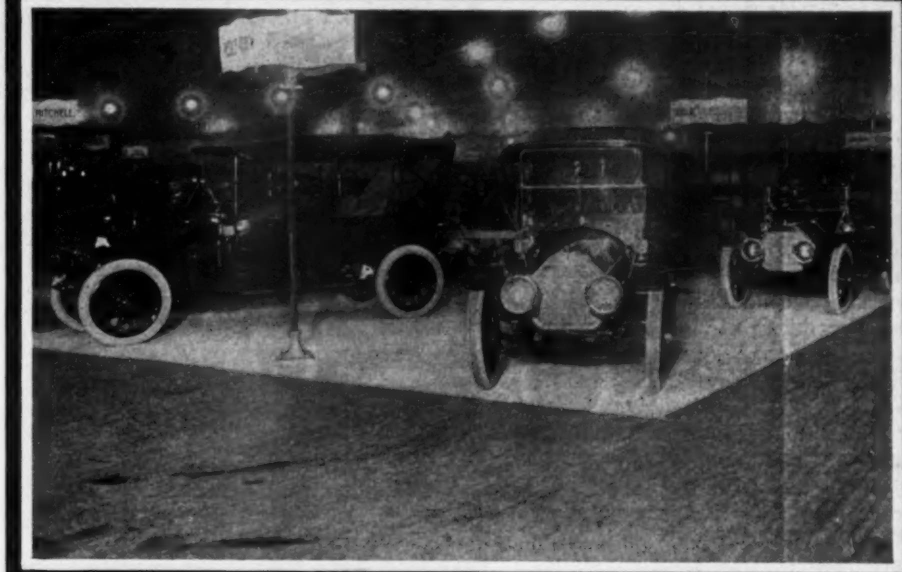
In the meantime the legislative situation has had the effect of putting a momentary damper on automobile trade with Canada. The reason is that the buyers are holding off from making contracts of purchase until the result of the treaty negotiations is known. They do not wish to submit to a heavy payment on account of customs duties if such payment is to be rendered unnecessary within a comparatively brief period.

But that unusual condition is not preventing hundreds of Canadians from attending the show at Buffalo. Nor is it deterring them from inspecting the big line of splendid automobiles, nor from selecting the cars that they intend to purchase, nor from actual purchases, conditioned upon the enactment of the treaty.

And through the horizontally driven snow, carried with stinging force on the wings of the Northwest wind, the Canadians are turning out in considerable numbers to have a look at the last word in automobile construction, hoping that in the course of a short time they shall have the opportunity of driving their selections across the line without being forced to pay a disproportionate amount for that privilege.



Poppenberg exhibit on left, with Detroit Electric bringing up the rear



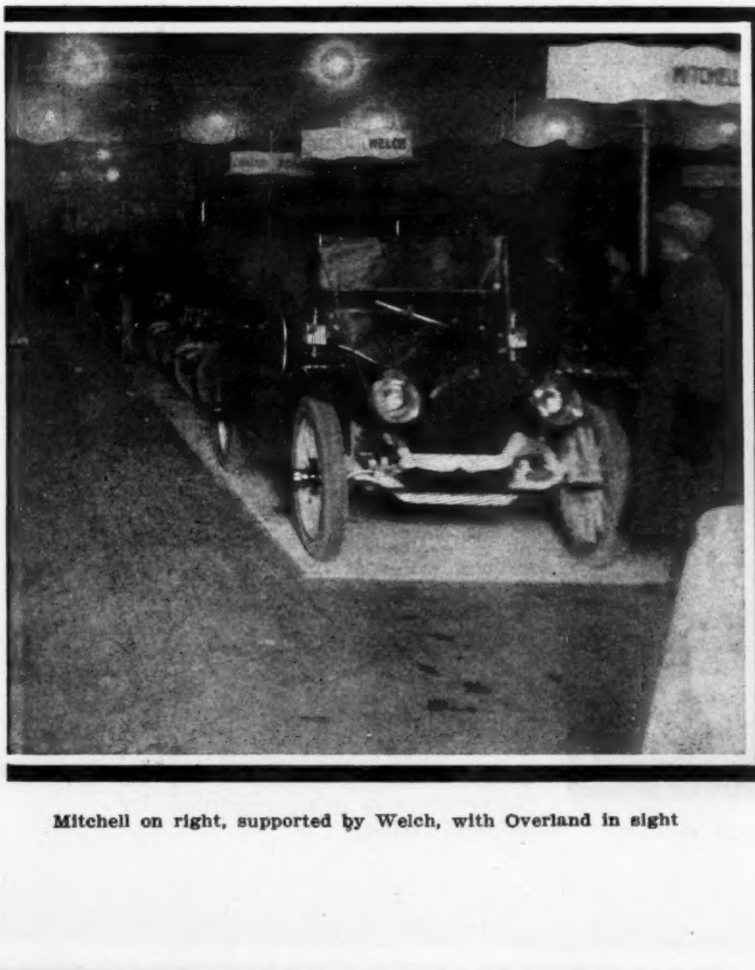
Pierce-Arrow exhibit. This is one of Buffalo's own companies

The show will continue through the week, ending at 10:30 o'clock Saturday night. The doors of the Arsenal will be thrown open to the public at 10 o'clock every morning, and the closing time for each day will be the same as that for Saturday. Each afternoon and evening there will be concerts by the 74th Regiment Band under the direction of Leader Bolton.

Buffalo as Factory Center

Seven manufacturers of automobiles are located in Buffalo and over 150 makers of accessories have establishments there as well. The automobile makers include the Atterbury Motor Car Company, making both gasoline and electric trucks; the Babcock Electric Carriage Company, manufacturers of the Babcock Electric; the Cyphers Motor Car Company, gasoline commercial vehicles; the E. E. Denniston Company, gasoline commercials; Pierce-Arrow Motor Car Company, gasoline automobiles; the E. R. Thomas Motor Company, gasoline automobiles and the Victor Motor Truck Company, gasoline and electric commercials.

The accessory makers range all the way from varnish and polish makers to factories in which heavy drop forgings and complete motors are turned out.



Mitchell on right, supported by Welch, with Overland in sight

Several of the cars made in Buffalo have world-wide reputations for speed, elegance, reliability and utility and almost from the beginning of automobile manufacturing in this country, Buffalo has played an important part and to-day is keeping step with the procession of progress.

All told the amount of capital invested in the various automobile and accessory factories in Buffalo is estimated at over $30,000,000. The annual gross income of all the plants is somewhere in the neighborhood of $30,000,000 and as a result the importance of the industry in the commercial scheme of Buffalo is particularly noteworthy.

The city is magnificently situated as a strategic trade point, having ample water and rail lines and being set in the midst of a rich trade field. Modernness is the keynote of Buffalo manufacturing. Economy in the small things of practice has been developed in stringent measure and it is due to this careful scrutiny of manufacturing methods that prestige of the city rests to a certain extent.

The Buffalo cars exhibited at the show are valued at about $100,000, a testimony of their high grade and esteem in the minds of the American public. The total valuation of all the cars shown is something more than $3,000,000 and the total value of all the exhibits on the floor of the Arsenal, including the accessories, stripped and sectional chassis, motors on show and other displays, has been estimated as high as $3,500,000. Measuring in direct values, not counting the indirect bearing it has.

At the show 118 men are employed in various capacities and the representatives of the exhibitors bring the total up to nearly 400 persons. The daily pay of all these men is about $2,000.

There are about forty local agencies and factory branches in Buffalo, representing practically all the standard automobiles of the country, some of the lines including five or more distinct makes. Even the newcomers in the manufacturing field report that their Buffalo representatives have done considerable business and that the local outlook is satisfactory. The city, which has the largest automobile club in the world, has always been noted as a great selling territory on account of the fact that the public was perhaps better educated to the motor than that of any other city of similar size in the United States.

It has long been noted that the automobile salesman in Buffalo did not need to argue anything about the fundamental advantages of the automobile in general, because the prospective buyer always knew and was convinced before beginning his search for a car that the automobile in general was a good thing to have. Consequently, all the Buffalo salesmen have to

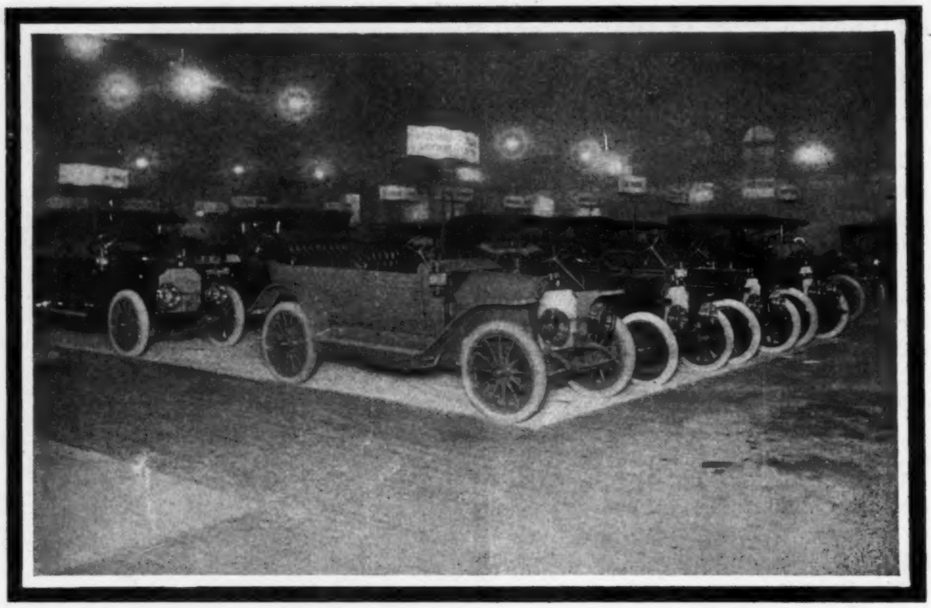
do is to emphasize the advantages of their particular makes of cars.

This education has produced a very discriminating buying public and the quality of cars owned by Buffalonians is high, even in those instances where the prices paid are low.

On the other hand, this discrimination has made it easier to sell cars that possess intrinsic merit, irrespective of price.

The roads surrounding Buffalo are favorably comparable with those of almost any other section in the United States. Some of the highways are specially fine and afford the motorists of that place a particularly good field for short touring. The whole lake country of New York is at their doors and it may be said that the average mileage of Buffalo-owned cars is quite as high as it is in any other section where there are four seasons.

The elimination of the automobile industry, if such a thing were possible to accomplish overnight, would strike Buffalo harder than any other city in New York and, with a few exceptions, with more stunning force than any other city in the land; but the industry is so thoroughly incorporated into the commercial life of the world that such a result is only thinkable as a comparison to emphasize the value of the industry.



Stoddard-Dayton in foreground, Columbia at right side, and De Tamble on the left flank showing the line-up of the cars

Big Show at Hartford

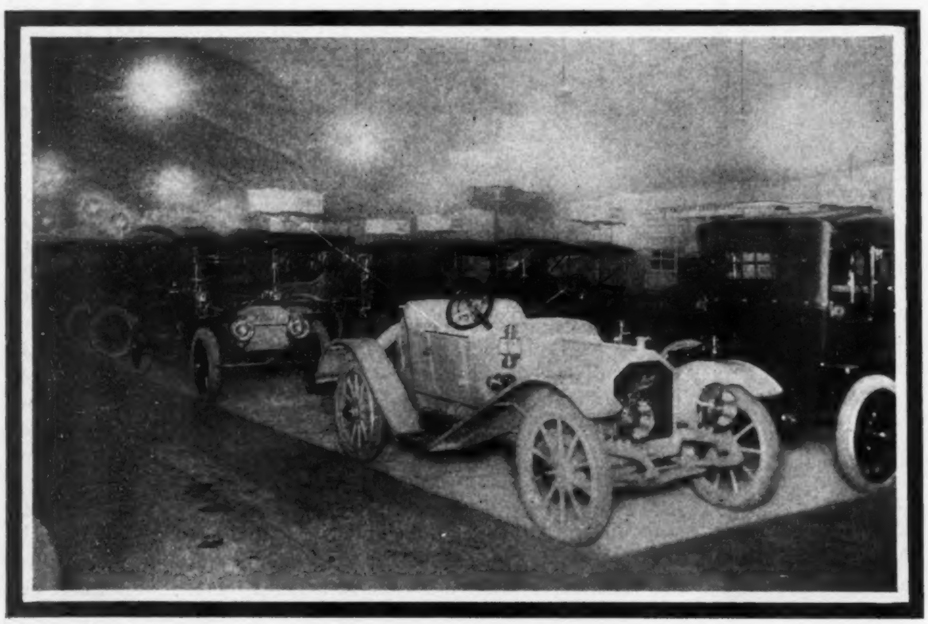
Hartford, Conn., Feb. 6—The automobile show of the Hartford Automobile Dealers' Association, which will be held in Foot Guard Hall, February 20-25, will, in all respects, excel any of the former shows of the association. Every inch of available space has been rented and many local dealers and agents find themselves unable to exhibit. The demand has been far in excess of the available space and and it is recognized that by next year the association will have to seek larger quarters.

About 100 automobiles will be exhibited and there will also be exhibits of accessories and supplies galore. There will be a special concert every afternoon and evening during the progress of the show. A souvenir program in the form of a stein has been issued and will be distributed at the show.

Newark's Show to Make Record

Newark, N. J., Feb. 6—When the applications for space closed last week it was found necessary to cut down the allotments for several of the largest dealers, with the view of letting in as many as possible and adding greater variety to the exhibits, and even then it was found that the huge military building, the largest armory in the State of New Jersey, was inadequate to accommodate all of those who desired to exhibit their products.

The combined value of the exhibits that are to be displayed figures out close to a million dollars, ranging from the little $400 runabout to the palatial limousine. More than $30,000 will be spent for decorations, floor covering, lighting, antique aisle lanterns, music and other contingents, incidental to the conduct of the show on a proper basis.



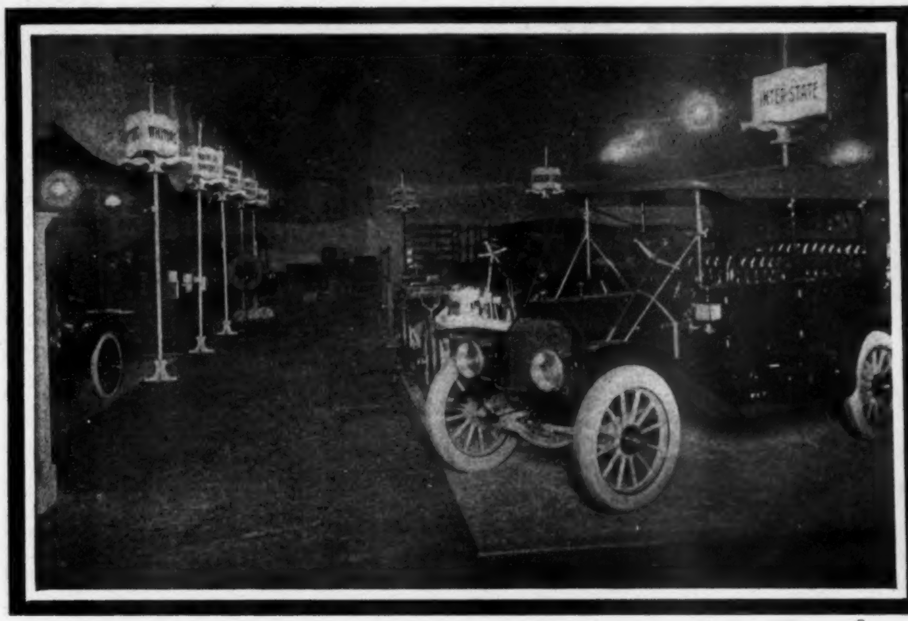
Pullman in foreground, Franklin on the left flank, and Cole "30" at the right side

Two Weeks at Cleveland

Cleveland, Feb. 6—The Cleveland automobile show, which opens Feb. 18, will last two weeks. The first week of the show will be devoted to the display of pleasure cars.

During the second week commercial vehicles will hold full sway. For the first time the local factories, Stearns, Peerless, White and Garford, will exhibit their full line of commercial vehicles.

The committee in charge of the two exhibits, Fred R. White, Fred Wood, W. H. Barger, Frank Phillips and C. M. Brockway, have been visiting the Chicago show to secure suggestions for the local exhibit.



Inter-State in foreground, Whiting on the left, and other cars bringing up the rear

The Binghamton Show

BINGHAMTON, N. Y., Feb. 6—Opening February 21 and remaining in session until February 25, the second annual automobile show to be held in this city will be presented to the public. Last year some forty-five models were shown on the main floor, but when the display is ready this year there will be sixty-five or more complete automobiles on exhibition in the same space, and in addition the subfloor of the armory will contain numerous exhibits.

Portland's Individual Show

PORTLAND, ORE., Jan. 30—The Rose City has been in the throes of its greatest automobile show for over a week and an immense amount of interest has been aroused through it. The show was held in the individual homes of the various makes of cars, where special decorations, entertainment and display had been arranged. The list included the following: Packard, Baker, Rauch and Lang, Locomobile, Oakland, Frayer-Miller, Velie, E-M-F, Flanders, Columbia, Maxwell, Alden-Sampson, Speedwell, Winton, Warren-Detroit, Oldsmobile, Reo, Apperson, Kisselkar, Overland Auburn, Stoddard-Dayton, Cole, Krit, Peerless, Chalmers, Hudson, Pope-Hartford, Pierce-Arrow, Cadillac, Hupmobile, Cartercar, Elmore, Buick, Franklin, Mitchell, Jackson, White and the Ford.

Chicago Cars for Omaha Show

OMAHA, NEB., Feb. 6—Arrangements are now practically complete for the sixth annual show of the Omaha Automobile Dealers' Association, which opens at the Auditorium Monday night, Feb. 20. C. G. Powell, secretary of the association, visited the Chicago show, interviewing many manufacturers about sending cars exhibited at that show to the Omaha show.

Scranton Enjoys Its First Show

SCRANTON, PA., Feb. 6—For the first time, Scranton has enjoyed a first-class automobile show and the trade and public united to make it a big success. The show opened January 30 and continued through the week, attracting ever-increasing attendance and patronage.

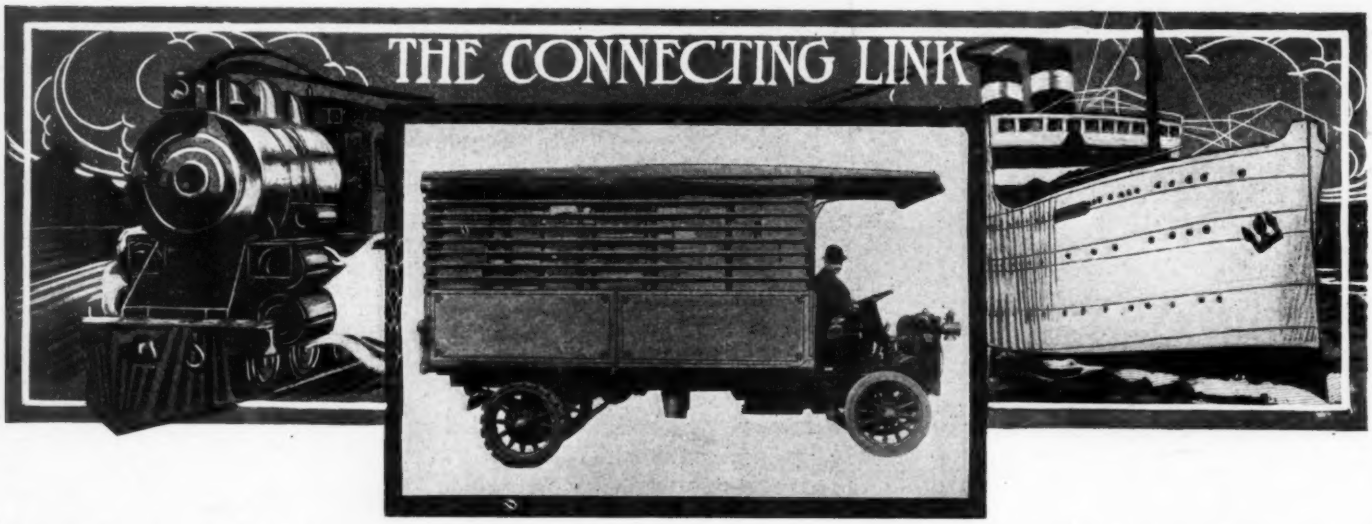
The Town Hall was used as an exhibition building and over forty different makes of automobiles were displayed by the agents for the various kinds of cars. For a dealers' show, the affair had a large display of accessories. There was a fine military band giving concerts throughout the exhibition. The decorations were artistic and well carried out.

The show was modeled after New York and society night was a distinct success in every way.

The cars shown and their exhibitors were as follows: Anthracite Motor Car Co., Overland and Corbin; Lackawanna Auto Co., Packard, Chalmers and Hudson; Electric City Auto Co., Lion "40," Rambler, I. H. C. and Atterbury trucks; Keystone Auto Co., Marmon and Marmon truck; V. A. Simrell, Speedwell, E-M-F "30" and Firestone-Columbus; C. B. Scott, Stevens-Duyrea; A. M. Baker, Jr., Hupmobile; John H. Fleming, Premier and Cadillac; Scranton Automobile Co., Peerless, Winton, Buick, Franklin and the Mack truck; Peter Beyreut, Haynes; Giles & Fly, the De Tamble; M. R. Zehnder, Stanley Steamer; Conrad Bros., Ford and Brush; P. J. Needham, Maxwell; Phil Rinsland, the Reo; Motor Cycles Sales Co., motorcycles. The accessory exhibitors are: The Scranton Automobile Co., the Atlantic Refining Co., the Wayne Tank Co., the Kitsee Battery Co., C. B. Scott, the Keystone Lubricating Co., the Standard Top Co., and the Tiona Oil Co. Many of the auto exhibitors had from three to five models of their cars in the show.

Peerless in the foreground and a general view of the hall, showing the disposition of the automobiles

Commercial Section of Chicago Show Opens Under Promising Auspices



CHICAGO, Feb. 6—The National Association of Automobile Manufacturers has every reason to believe that the commercial car show which opened at 10 o'clock this morning in the Coliseum will be fully as successful as the big affair in Madison Square Garden in New York last month. not only from the standpoint of attendance but also in the volume of business done. If it isn't it will not be because a systematic canvass of the entire country has not been made by the management, for not a stone has been left unturned to interest representative business men in the commercial power wagon and to secure their attendance at the show.

For the last two months this canvass has been going on, during which time 25,000 letters were sent out by the management, which has received favorable replies from more than 5,500, the writers of which have given assurances that they are interested in the proposition and that they will attend the show. In sending out these letters Bradstreet's and Dun's were consulted and every business man with a rating of $50,000 or more was written to and told of the great show that was to be held. In the letter zone were Western New York, Pennsylvania, Minnesota, North Dakota, Montana, Colorado, Oklahoma, Tennessee, Missouri, Wyoming, Washington and other points on the Pacific Coast.

The only exceptions were the New England and Atlantic States, which were passed up because it was figured that because of the exhibition of motor trucks made at New York and which will be made in Boston next month would be sufficiently close to home to make it unnecessary for the business men in those sections to travel to Chicago.

The letter scheme was an exhaustive one and started more than two months ago. In the first letter sent the scope of the show was entered into and the business men told of the great variety of power wagons that were to be shown. Each business man was asked frankly if he was interested and even if he wasn't to reply and let the management know. Those who paid no attention to the first letter were sent a second and when even that failed to evoke an answer a third was sent. Of course many of the 25,000 canvassed replied that either they could not find the time to come or were not ready to consider the proposition at present, but after the canvass had been reviewed it was discovered that more than 5,500 had agreed to come on for the show.

Not only were the business men themselves invited to attend but the management went even farther by interesting officials of other cities and towns who might be in the market for commercial wagons. Particular attention was paid to fire departments and the fire chiefs were told of the fine display of fire-fighting motor apparatus that was to be made here. As a result of this the management has on its list the names of 150 city officials who have accepted the invitation to be among those present. In most instances mayors of towns have promised to come, and among the places that will be represented at the show by city officials are those from Elgin, Aurora, Freeport, Joliet, Peoria, Rockford, Springfield, Streator, Waukegan in Illinois; Kokomo, Michigan City and South Bend in Indiana; Cedar Rapids, Davenport, Fort Dodge and Waterloo in Iowa; Benton Harbor, Manistee and Muskegon in Michigan; Springfield, O., and Racine, Wis. The entire board of public service is coming from Indianapolis; Memphis will send a delegation and so will Council Bluffs, Ia.; Sioux Falls, N. Dak.; Paducah, Ky., and Leavenworth, Kan. Postmasters are expected from Milwaukee, La Crosse, Wis.; Duluth, Minn.; Sheboygan, Wis.; Racine, Wis.; Aurora, Ill.; Joliet, Ill.; Logansport, Ind., and Cedar Rapids, Ia.

The show opened this morning twelve hours ahead of the time originally scheduled, demonstrating how well organized are the show forces. The management figured out that by opening this early they could hold over many of those from the pleasure car week who might like to take a peep at the commercial show before returning home and who possibly would not have done so had they been forced to wait until to-night. The wisdom of this move was fully exemplified by the attendance this morning and this afternoon when the show building was comfortably filled not only by agents but by representative business men. The exhibit opened with 57 concerns displaying power wagons, 150 companies handling accessories and 19 motorcycle builders.

There has not been any falling off in the accessories ranks, for while 30 withdrew from the annex and one from the Coliseum Saturday night, their places were immediately taken by others which make a specialty of commercial sundries. The commercial forces took possession of the building yesterday and moved in without a hitch. The doors of the annex were opened at 9 o'clock yesterday morning at which time Wabash avenue was jammed with big trucks and light delivery wagons. Quickly but without confusion the cars started to go in and at noontime the street had been cleared and by 2 o'clock all but two or three of the exhibits had been placed, while the stragglers all were in before 6 o'clock. So well carried out were the plans that had the management desired to open the show yesterday afternoon it would have been possible to have done so.

The commercial show is confined entirely to the Coliseum and its annex, the armory having been given up. As the show is

laid out all the commercial cars with the exception of three concerns which went into the the annex from choice are located on the main floor of the Coliseum. The accessories people who were in the gallery in the Coliseum have stayed there while more of them are found on the second floor of the annex. The first floor of the annex has been given over to the motorcycle display. The show decorations are the same that were used last week, but the spaces have been changed about considerably in order to accommodate the big machines that are on view.

In the main the spaces are larger than last week and the spreading out of the show has if anything added to its beauty. Only one of those concerns which were in last week has stuck to its original camping place, that being the Packard, which is at the north end of the main aisle. However, the Packard people have been obliged to overflow into the old Stearns space to the south in order to properly display its seven commercial wagons.

While the gasoline car is in the big majority there is a good representation of electrics including the Studebaker, Waverley, Baker, General Vehicle, Lansden, Automobile Maintenance and Detroit. There are four fire-fighting machines on view, including the Knox, Packard, Rambler and Kisselkar. The Knox comes into the show after a public demonstration of its efficiency Saturday afternoon when the Knox company invited local firemen to watch the operation of the big machine. At the Madison street bridge the demonstration was hampered somewhat by a stiff wind, but despite this the Knox engine threw a stream across the river, much to the astonishment of the firemen, who had not looked for such a powerful demonstration.

List of Exhibitors at the Commercial Section of the N. A . M. Show

COMPLETE VEHICLES AND CHASSIS

Mack Bros. Motor Car Company, Allentown, Pa.
Mais Motor Truck Company, Indianapolis.
U. S. Motor Truck Company, Cincinnati, O.
Hart-Kraft Motor Company, York, Pa.
White Company, Cleveland, O.
Studebaker Bros. Manufacturing Company, South Bend, Ind.
Alden Sampson Manufacturing Co., Pittsfield, Mass.
Courier Car Company, Dayton, O.
W. H. McIntyre Company, Auburn, Ind.
Waverley Company, Indianapolis, Ind.
Reo Motor Car Company, Lansing, Mich.
Willys-Overland Company, Toledo, O.
Cartercar Company, Pontiac, Mich.
Grabowsky Power Wagon Company, Detroit.
Garford Company, Elyria, O.
Packard Motor Car Company, Detroit.
Pope Manufacturing Company, Hartford, Conn.
Avery Company, Peru, Ind.
Reliance Motor Truck Company, Owosso, Mich.
Rapid Motor Vehicle Company, Pontiac, Mich.
Peerless Motor Car Company, Cleveland, O.
American Locomotive Company, New York.
Pierce-Arrow Motor Car Company, Buffalo.
Metzger Motor Car Company, Detroit.
H. H. Franklin Manufacturing Co., Syracuse, N. Y.
Knox Automobile Company, Springfield, Mass.
Kissel Motor Car Company, Hartford, Wis.
Kelly Motor Truck Company, Springfield, O.
Independent Harvester Company, Plano, Ill.
Adams Bros. Company, Findlay, O.
Thomas B. Jeffery Company, Kenosha, Wis.
General Vehicle Company, Long Island City, N. Y.
Chase Motor Truck Company, Syracuse, N. Y.
Saurer Motor Trucks, Chicago.
Atlas Motor Car Company, Springfield, Mass.
Mercury Manufacturing Company, Chicago.
Dayton Auto Truck Company, Dayton, O.
Chicago Commercial Car Company, Chicago.
Lansden Company, Newark, N. J.
Federal Motor Truck Company, Detroit.
Automobile Maintenance Company, Chicago.
F. B. Stearns Company, Cleveland, O.
Economy Motor Car Company, Joliet, Ill.
Anderson Carriage Company, Detroit, Mich.
Monitor Automobile Works, Janesville, Wis.
Clark Delivery Car Company, Chicago.
Schmidt Bros. Company, Chicago.
Brodesser Motor Truck Company, Milwaukee.
Sternberg Manufacturing Company, Milwaukee.
Harder's Fireproof Storage and Van Co., Chicago.
Van Dyke Motor Car Company, Detroit, Mich.
Haberer & Co., Cincinnati, O.
R. L. Morgan Co., Worcester, Mass.
Baker Motor Vehicle Co., Cleveland, O.
Kinnear Mfg. Co., Columbus, O.
Couple Gear Freight Wheel Co., Grand Rapids, Mich.
Albrecht-Cramer Auto Truck Co., Milwaukee, Wis.
Waterville Tractor Co., Waterville, O.
Buick Motor Co., Flint, Mich.
Schacht Motor Car Co., Cincinnati, O.
Marquette Motor Vehicle Co., Chicago, Ill.

LIST OF ACCESSORIES EXHIBITORS AT THE CHICAGO COMMERCIAL SHOW

1—Michelin Tire Co.
2—Lovell-McConnell Mfg. Co.
3—Vesta Accumulator Co.
4—Standard Roller Bearing Co.
5—Herz & Co.
5a—Hayes Mfg. Co.
5b—Imperial Brass Mfg. Co.
6—C. T. Ham Mfg. Co.
7—Jones Speedometer Co
8—N. Y. & N. J. Lubricant Co.
C. A. Mezger.
9—Weed Chain Tire Grip Co.
10—Continental Caoutchouc Co.
11—Valentine & Co.
12—Wheeler & Schebler.
13—Conn. Telephone & Electric Co.
14—Swinehart Tire & Rubber Co.
15—A. O. Smith Co.
16—Consolidated Rubber Tire Co.
17—Heinze Electric Co.
18—Pennsylvania Rubber Co.
19—Warner Instrument Co.
20—Republic Rubber Co.
21—Republic Rubber Co.
22—McCord Mfg. Co.
23—Whitney Mfg. Co.
24—Briscoe Mfg. Co.
25—Joseph Dixon Crucible Co.
26—Morgan & Wright.
27—Morgan & Wright.
28—Standard Welding Co.
29—American Ball Bearing Co.
30—Hartford Rubber Works Co.
31—Hartford Rubber Works Co.
32—Timken-Detroit Axle Co.
33—Timken Roller Bearing Co.
34—R. E. Dietz Co.
35—Diamond Chain & Mfg. Co.
36—Gray-Hawley Mfg. Co.
37—Wm. Cramp & Sons' Ship and Engine Building Co.
38—Fisk Rubber Co.
39—Fisk Rubber Co.
40—National Tube Co.
41—Badger Brass Mfg. Co.
42—Veeder Mfg. Co.
43—Gray & Davis.
44—G & J Tire Co.
45—G & J Tire Co.
46—National Carbon Co.
47—B. F. Goodrich Co.
48—B. F. Goodrich Co.
49—C. F. Splitdorf.
50—Gabriel Horn Mfg. Co.
51—Goodyear Tire and Rubber Co.
52—Goodyear Tire and Rubber Co.
53—Long Mfg. Co.
54—J. H. Williams & Co.
55—Diamond Rubber Co.
56—Diamond Rubber Co.
57—Warner Gear Co.
58—A. W. Harris Oil Co.
59—Hartford Suspension Co.
60—Hartford Suspension Co.
61—Baldwin Chain and Mfg. Co.
62—Spicer Mfg. Co.
63—Brown-Lipe Gear Co.
64—Pittsfield Spark Coil Co.
65—Continental Motor Mfg. Co.
66—Remy Electric Co.
67—Firestone Tire and Rubber Co.
68—Firestone Tire and Rubber Co.
69—Electric Storage Battery Co.
70—Oliver Mfg. Co.
71—S. F. Bowser & Co.
72—S. F. Bowser & Co.
73—Edmunds & Jones Mfg. Co.
74—Kokomo Electric Co.
75—Byrne, Kingston & Co.
76—Superior Motor Vehicle Co.
76a—U. S. Light and Heating Co.
77—Motz Clincher Tire and Rubber Co.
78—Warner Mfg. Co.
79—Racine Auto Tire Co.
80—Garage Equipment Mfg. Co.
81—Auto Parts Mfg. Co.
82—Royal Equipment Co.
83—Royal Equipment Co.
84—Muncie Gear Works.
85—Gemmer Mfg. Co.
86—Excelsior Motor and Mfg. Co.
87—Stromberg Motor Devices Co.
88—Stromberg Motor Devices Co.
89—Havoline Oil Co.
90—Cook's Standard Tool Co.
91—Thermoid Rubber Co.
92—Thermoid Rubber Co.
93—Power Wagon.
94—Horseless Age.
95—Auto Improvement Co.
96—American Ever Ready Co.
97—Homo Co. of America.
98—Ross Gear and Tool Co.
99—Whiteley Steel Co.
100—Turner Brass Works.
101—Edison Storage Battery Co.
102—Driggs-Seabury Ordnance Corp.
103—National Coil Co.
104—Link-Belt Co.
105—Stewart & Clark Mfg. Co.
106—Cleveland Speed Indicator Co.
107—Empire Tire Co.
108—Empire Tire Co.
109—Western Motor Co.
110—Eisemann Magneto Co.
111—Eisemann Magneto Co.
112—Sparks Withington Co.
113—Columbia Lubricants Co.
114—Randall-Faichney Co.
115—Continental Rubber Works.
116—Briggs Mfg. Co.
117—Cycle and Auto Trade Journal.
118—Bosch Magneto Co.
119—Bosch Magneto Co.
120—E. B. Van Wagner Mfg. Co.
121—Morrison-Ricker Mfg. Co.
122—Universal Tire Protector Co.
123—Findeisen & Kropf Mfg. Co.
124—Perfection Spring Co.
125—International Metal Polish Co.
126—Commercial Vehicle.
127—Simms Magneto Co.
128—Frank E. Sparks.
129—H. H. Franklin Mfg. Co.
130—Automatic Motor & Engineering Co.
131—Model Gas Engine Works.
132—Model Gas Engine Works.
133—Briggs & Stratton Co.
134—C. Cowles & Co.
135—Motor Vehicle Publishing Co.
136—Nathan Novelty Mfg. Co.
137—Detroit Lubricator Co.
138—Eagle Co.
139—Cleveland-Canton Spring Co.
140—R. M. Hallin Phead Co.
141—Hayes Wheel Co.
142—Atlas Chain Co.
143—Adams & Westlake Co.
144—Willard Storage Battery Co.
145—Lutz-Lockwood Mfg. Co.
146—Sheldon Axle Co.
147—Sheldon Axle Co.

The Delivery of Goods

The Plan, if It Is Well Contrived, Is More Than Half the Battle.

There Are a Number of Plans of Battle to Choose from When Undertaking the Delivery of Goods on a Large Scale

LET there be no mistake; the great question is to see things as they are; the plan of battle must be comprehensive. The system to use in the delivery of goods under a certain set of conditions is the one that will show up the best from the theoretical point of view. The old practitioner will say, "hang theory." That is what he does! But the trouble with this plan is that theory will not stay hanged. There was never a hangman who could so thoroughly strangle theory that it would remain inanimate for even the time that it takes for the hangman to catch his breath.

The theory of the delivery of goods is very simple, taking it in the main, as it is assumed that it is a mere matter of getting a customer to order and name the time and place of delivery of the merchandise. All that remains is to make the delivery to the given address within the time allowance stated. The first difficulty comes when the merchant finds that his business is growing beyond his capability; when he discovers that he cannot take the time to make the delivery personally.

There are two reasons why a merchant may not be able to do his own delivery work. The merchandise may be too heavy to be carried by him, or the amount of business that the merchant can do if he gets others to perform detailed services may be so great that it will be more profitable for him to engage other men to do the assisting, such as delivery work, giving to them the necessary facilities so that they will be able to accomplish enough work per day to make it a profitable undertaking. Of course, it would not pay a merchant of scope to deliver the goods sold, doing all the work personally, unaided by such facilities as delivery wagons. Those who resort to such means are never more than "push-cart" men, and yet there are merchants who are merely push-cart men in a more general way than when the language is taken literally.

The primary system is that of the "push-cart" man, and the latter is the graduated errand boy. From the push-cart man to the merchant who employs delivery wagons is quite a step, but it is no more of a breach than that which reaches from the one-horse delivery wagon to the more complex method involving long and short hauls, coupled with a multiplicity of details that have to be worked out under a variable set of conditions using automobiles.

Just what the equipment should be composed of in delivery work depends upon the class of merchandise that must be delivered; also upon the topographical features of the place, class of customers and the extent of the enterprise in each individual instance.

The time of delivery of merchandise is stated by the patron who orders the goods as a rule. It is just as important to be able to deliver one package at a stated time as it is to deliver a large amount of merchandise within a certain period of time. The only difference between the two propositions is that in the handling of a large business, if the goods are not cleared each day, storage room will have to be provided for the hold-overs, and this is at an added cost as well as at quite some dissatisfaction of the customers.

Law of the Delivery of Merchandise

The freight rate of a well-equipped railroad that is made to pay a reasonable dividend upon its stock and is held capable of continuing to serve its clientèle year after year may be taken as the broad basis; this rate will then be the base rate. The average time it takes to deliver goods by freight under such conditions should be taken as the base-time of delivery. The average size of package, delivered under "freight" conditions, will be the bulk unit. The average weight of package delivered under "freight" conditions will be the weight-unit.

The method of computation for the ascertaining of the efficiency of the system will have to be worked out depending upon how speedily the delivery is made. If delivery work is done on a "convenient" basis, it follows that the "ton-mile" is the proper foundation of computation, but if a specific time of delivery must be taken the ton-mile idea is lacking in some respects, but it might be nearer the truth to assume that the value of the delivery will be proportional to MV^2, when $M =$ mass, and $V =$ velocity.

The value of a delivery is (A) proportional to the mass, and

(B) to the square of the speed of delivery.

(C) modified by the consideration of bulk, since the larger the package the more room it will take up.

(E) Taking into account the fact that the goods may be perishable, fragile or explosive.

(F) Taking due notice of the problems of insurance, and who insures the goods.

That the questions involved in the velocity-squared law are most complex may be shown as follows:

(a) The wagon depreciates in proportion to the square of the velocity.

(b) The roadbed is depreciated in proportion to the square of the velocity.

(c) The risk, involving accidents, is in proportion to the square of the velocity.

On the other hand:

(d) The rate of delivery of merchandise is in direct proportion to the velocity.

(e) The wages paid out to workmen is in direct proportion to velocity and to mass.

(f) The interest on the investment is in direct proportion to velocity and to mass.

From what has been said it would appear that all the chances of trouble and cost are in proportion to the square of the velocity and all the gains are in direct proportion to velocity. This is probably true; it means that skill is essential to success. The man of skill has a great advantage over the man of no skill. The merchant who can skillfully determine the proper speed of delivery of goods will be able to make deliveries at a far lower cost than the cost of delivery of the same goods by a merchant who fails to observe that there is such a thing as delivering goods too quickly or too slowly.

It is just a little strange according to the usual way of thinking, but there is more danger attached to doing the work at a fast rate than there is in fixing a relatively slow rate of performance.

There Are Several Choices to Take

Interpreting the square law and assuming that the day is the long unit of time, it is possible to take advantage of time and thwart the square idea to a relatively large extent. If it is desired to deliver ten tons of merchandise from one point to another distanced, say, ten miles, within a day, this task may be performed by a one-ton truck making one trip every hour, or the task may be performed by a five-ton truck making a trip in five hours, or it may be performed by a ten-ton truck making one trip in ten hours. Assuming for the moment that each truck is capable of sustaining under its rating with equal facility, it remains to determine the effect of the different rates

THE FARMER IS NO LONGER RAILROAD DISTANCE FROM HIS MARKET IN THE CITY—WORLD BENEFITS ACCORDINGLY

Motor bicycles being taken to the show by motor truck

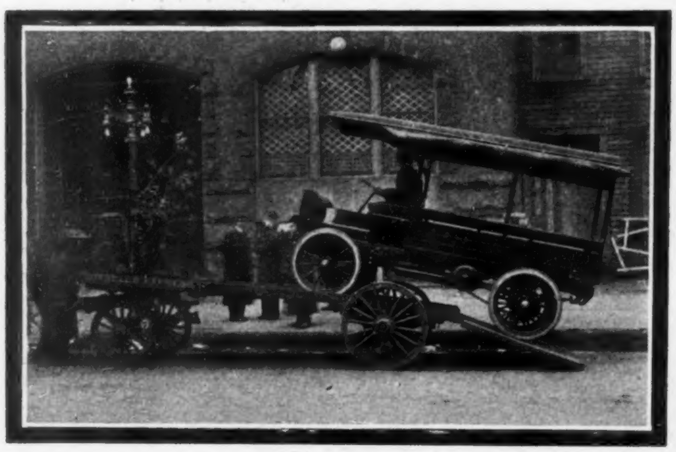
$50,000,000 IS THE VALUE IN THE AGGREGATE BEING TURNED OUT IN RESPONSE TO REQUIREMENT OF COMMERCIAL VEHICLES VEHICLES. IT HAS BEEN SHOWN THAT ONE OF THREE "ANIMAL DRAUGHTS" AND IMMEDIATE DEMAND, LIMITING IT TO FREIGHT FREIGHT AUTOMOBILE IS ESTIMATED TO THIS TYPE OF TRANSPORT WILL HAVE TO WITHIN THE NEXT DECADE. THE VALUE OF PRESUMPTION WILL BE $6,000,000,000.

of speed upon the several trucks according to the square law. The results will be as follows:

COMPUTING DEPRECIATION FROM SPEED OF TRAVEL

Size of truck	Miles per hour	Relative depreciation
1 ton	10	100
5 ton	2	4
10 ton	1	1

Whether or not this is exactly so, is a matter of no great moment, provided it can be stated with a showing of truth that it is the strong tendency. There is one other point that shows up with great clearness, *i. e.*, the labor item is in favor of the ten-ton truck. When all of the goods are delivered in one load on one big truck but one driver is required. If two trucks



The last of the horse and the first of the trucks to the show

are used two men must be employed, and if ten trucks are employed ten men must be at hand to drive them.

In the same way, since "roundhouse" attention must be accorded to every truck, it stands to reason that the more trucks that are employed the greater will be the number of men that will have to be employed in the "roundhouse."

Looking at it from another point of view: if skilled labor is difficult to find and keep the difficulty is relatively great with ten trucks, due to the fact that it is just as much of a task for a skilled man to maintain a one-ton truck as it is for him to maintain a ten-ton truck. It will require ten men in one case and only one man in the other case.

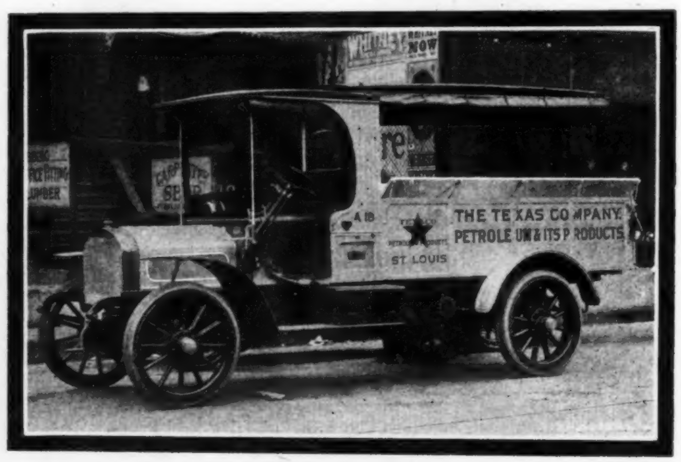
From the investment point of view there are problems that cannot be ignored. If ten one-ton trucks are worth, say, $30,000, two five-ton trucks will be worth, say, $8,000, and one ten-ton truck will be worth, say, $5,000. To the casual observer it would look as if the difference from the interest point of view would be a mere matter of computation as follows:

INTEREST UPON THE INVESTMENT AT 6 PER CENT.

Trucks	Value	Interest
10 one-ton trucks	$30,000	$1,800
2 five-ton trucks	8,000	480
1 ten-ton truck	5,000	300

Even in this computation there is evidence of a great difference in the interest increment, but in this plan no account is taken of the rate of depreciation of the one-ton truck at 10 miles per hour as compared with the five-ton truck at 2 miles per hour, or the ten-ton truck at 1 mile per hour.

According to the tabulation of depreciation from speed of



Mack open sided truck with driver's cab

Garford police patrol wagon for use in Racine

OF THE FREIGHT AUTOMOBILES THAT ARE IMMEDIATE DEMAND. THE NEAR FUTURE IS ESTIMATED TO BE ON A BASIS OF 3,000,000 FREIGHT AUTOMOBILE WILL DO THE WORK ACCORDING TO THIS RECKONING THE AUTOMOBILES, IS ABOUT 1,000,000. SINCE A WEAR OUT IN TEN YEARS THE BUILDERS OF PREPARE TO MEET THE 3,000,000 CAR DEMAND A DECADE OF OUTPUT ACCORDING TO THIS

travel, even assuming that the figures are not exact, the proper way to look at it is to re-write the interest table as follows:

RE-STATEMENT OF INTEREST UPON INVESTMENT ON A RELATIVE BASIS

Truck	Value	Relative Interest
1 ton	$30,000	6.0
5 ton	8,000	6.4
10 ton	5,000	1.0

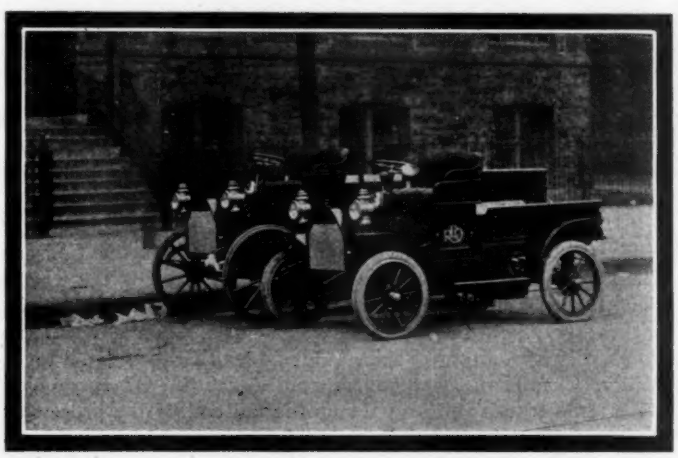
It is a mere matter of method to divide the interest increment into interest and depreciation, and for the sake of simplicity in bookkeeping most merchants do make this distinction. In the long run, no matter how books are kept, it is necessary to pay the costs, and, in dollars, the amount is the same.

Is there any truth in the assumption that the interest and depreciation will vary in the ratio of 1 to 600?

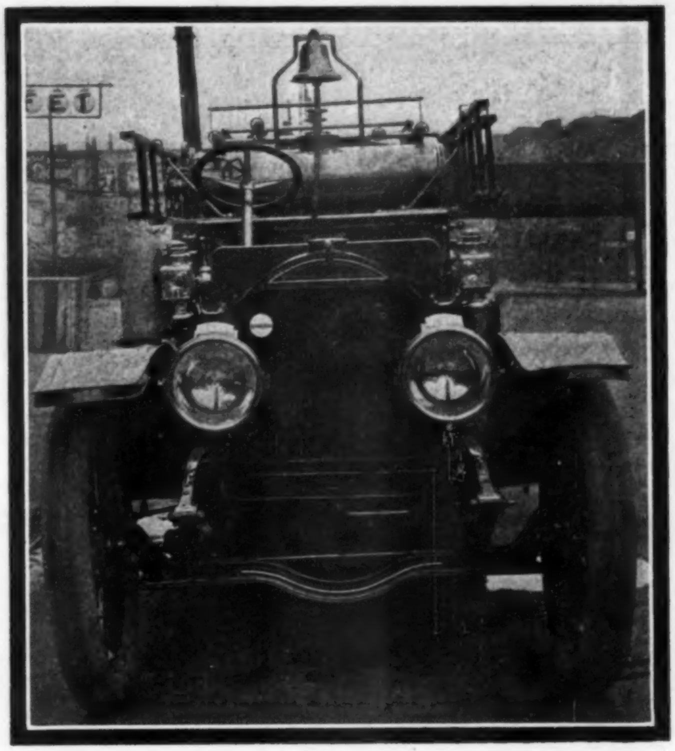
Unfortunately, yes!

Is there anything to be said against the methods here used in making the comparison? Fortunately or unfortunately, depending upon how the matter is viewed, as will be shown.

Studebaker Garford shallow-bodied quick delivery car



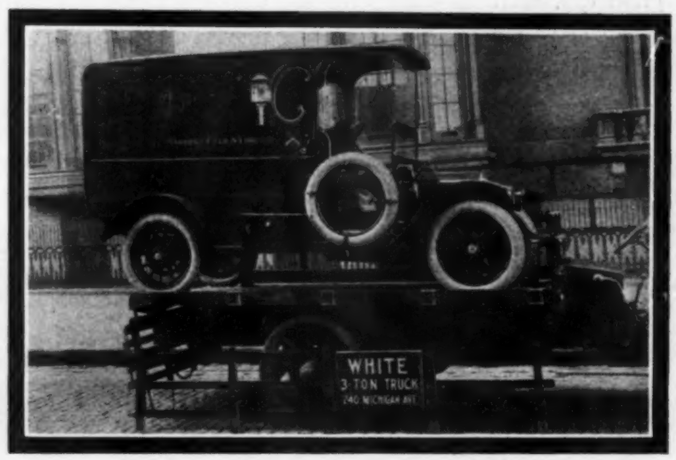
Two models of the Reo light delivery wagons. Note the difference in the size of the wheels



Kissel Kar fire fighter; chemical and hose wagon

In the first place, ten-ton trucks are not so made that they will travel at the low speed of 1 mile per hour. Again, the tire question is not as an open book. A ten-ton truck at a speed of 1 mile per hour would not have to be equipped with rubber tires, but ten-ton trucks, as they are made, are fitted with rubber tires, but then the speed of such trucks is nearer to 4 miles per hour, and at this higher speed it is more desirable to employ rubber tires.

On the other hand, in making concrete comparisons, one-ton trucks are not limited to 10 miles per hour; most makes of one-ton trucks are capable of traveling at approximately 20 miles per hour. The life of the truck, in view of this doubling of the speed, if the square law holds, will be one-fourth of what it would be at 10 miles per hour.



White delivery box body on White heavy truck

It is not the purpose here to split hairs about details or to contend in favor of a definite set of figures. The main point is that merchants have a large responsibility; they must figure out a system for the transportation of goods; it is up to them to be intelligent, and it remains for them to find out how the best results are to be realized. It is almost certain that slow-going, large-capacity trucks must be relied upon to do the trunk-line work, and that intermediate deliveries must be made by

Brodesser truck, with stake body

Four models of the Franklin commercial line—cab, open delivery truck, ambulance, and closed box body

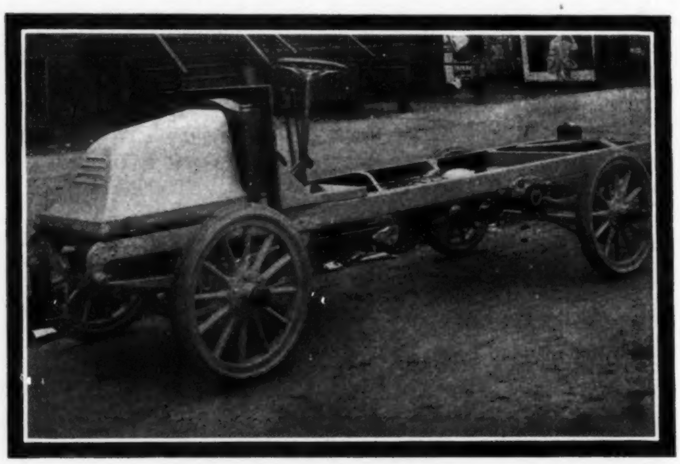
means of medium capacity trucks, leaving it for relatively small delivery wagons to do the local delivery work.

Local Conditions Have to Be Satisfied

What an easy thing it would be were it true that all merchants would have to deliver goods over the same zones in a given city, or if all cities were laid out in precisely the same way, and were all streets so well paved that there would be no road problem to figure in. But there are no two cities alike, nor will the deliveries of the respective merchants be on the same basis in a given city; even the districts hold problems that differ from each other to a material extent.

At the present time there is far too much attention being given to the individual questions; in other words, while technical papers are printing publicity about the high qualities of the different makes of trucks and delivery wagons, there are none who pay enough attention to the abstract needs of the several occasions. Merchants know how to deliver goods when horse-drawn vehicles are used, and this is another way for stating that they know how to fail in the delivery of goods when

Kelly truck, with driver's cab and open delivery body



Chassis of the Adams delivery truck

automobiles are employed in substitution of horse-drawn vehicles. It is as plain as anything can be that a new system will have to be worked out.

There is yet time to turn back and approach the whole matter on a basis that will be good for the automobile as a means of transportation and equally good for the merchant who will see the light.

Commercial Automobile Activity

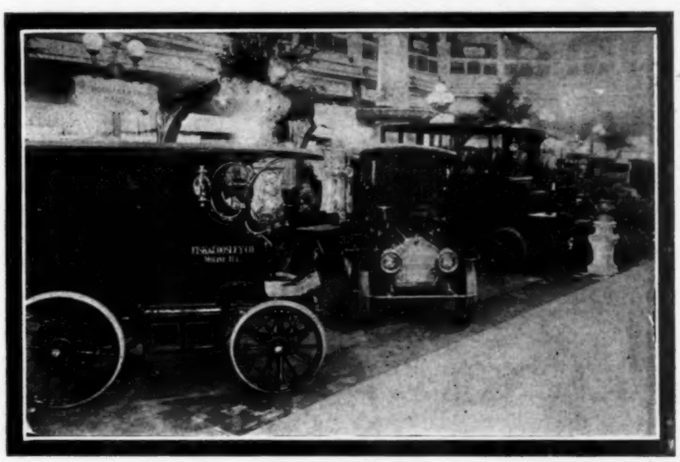
THE MEAT IN THE NUT AS IT IS BEING DISCUSSED AT CHICAGO BY AN ARMY OF EXPERTS GATHERED THERE

OUTSIDE Chicago was covered by a blanket of snow, the result of a blizzard which blew up and which tied up traffic. Those hit hardest by this change in the weather were the members of the Motor Truck Association of Chicago who had made arrangements for a parade through the loop district in order to attract the attention of the business men to the commercial show. They had been promised more than 150 machines belonging to business houses in the city, but the change in the weather kept many away, the result being that when the parade lined up this noon in front of the Coliseum there were only some thirty vehicles in line. Among the wagons that turned out for the demonstration were the following makes:—Walker, Lansden, General Vehicle, Couple Gear, Randolph, Chicago Motor, Rapid, White, Ideal, Grabowsky, Frayer-Miller, Champion, Chautauqua, and Reliance. Of these eight were large trucks and brought up the tail end of the procession.

Considering the weather conditions the parade was a good one, and the demonstration in the loop district must have been

an eye-opener for business men who are accustomed to seeing horse-drawn vehicles put in the stable when the snow falls when it is as heavy as it was last night. The turn-out of these machines, most of which were cars owned by local business houses, brought together many veterans. One of these was a Couple Gear truck which has been in the service of the Hammond Packing Co., a concern at the stock yards, for the last five years in which time it has ground out an average of 20 miles a day with very little trouble and which looks as sturdy to-day as many of the newer ones. There was a Randolph light delivery wagon, which has been running for the George W. Jackson Co., a contracting firm, since 1908, and which does its 50 to 75 miles a day. Henry Bauer, plaster contractor, had a Randolph truck which has been running for one and a half years, and which has been in the shop only once in that time, that being to fix a muffler. This wagon hauls scaffolding and boxes, the loads ranging in weight from 500 pounds to 1 ton. A 3-ton Frayer-Miller, operated by Libby, McNeil & Libby, the packers, has been in service 6 months, running 12 hours a day and averaging about 40 miles a day in the hardest kind of service. The driver says that he never was laid up an hour since he got the car and

White truck, with large platform body for bulky goods delivery



Studebaker stand, showing gasoline and electric commercials

that he uses not more than 7 or 8 gallons of gasoline and 2 quarts of oil a day.

Another Frayer-Miller belongs to the Wadsworth-Holland Co., a paint-making concern in this city, whose driver reported a mileage of 11,492 miles in the 13 months he has had the machine in which time he has been working 10 hours a day. A General Vehicle 3½-ton electric truck, used by Sulzberger & Schwarzschild, the packers, gets a maximum service by having two batteries. While the machine is out on its morning round the extra battery is being charged, while at noon the driver makes the change and leaves the partly discharged battery in the barn for recharging while he goes well equipped for the afternoon service. Because of the double battery he is in a position to get 40 miles a day out of his car, although his work does not call for that much, the daily distance being about 20 to 25 miles.

Another veteran in the parade was the Rapid 1-ton truck, which climbed Pikes Peak, and which has been in the Glidden tour. This truck has run 25,000 miles, it is claimed, since first being put on the road.

The Saurer, the only foreigner in the show, is exhibiting a 4½-ton truck and a 6-ton chassis. In addition to these there are other heavy trucks shown by the Alco, Baker electric, Avery, Kisselkar, Peerless, Garford, Grabowsky, White, Packard, General Vehicle, Sampson, Morgan, Kelly, Brodesser and Harder.

As the management is making a big play to attract city officials, it finds itself in a position to make good on the promises held out to the mayors, fire chiefs and others in that it has a strong line of machines designed for municipal use, including the Knox, Autocar, and Pope-Hartford, moreover, Chicago has five of this distinct type, three of which were not shown in New York.

There are to be seen here a Franklin, Packard, Kisselkar, Rambler, and Abrosch models, which are built for fire fighting purposes only, and in addition to this there are a Franklin ambulance, Knox ambulance, Studebaker ambulance patrol, Packard patrol, Waverley electric ambulance, Waverley hearse, and Lansden ambulance. In addition there is a variety of types shown which include Franklin and Atlas taxicabs, International harvester buggies, and an Adams touring car, the last named being the only touring car on view in the show and being displayed in connection with the Adams line of commercial wagons.

As the show is divided up, the total display takes in 129 cars of all kinds, and 31 chassis.

View showing the exhibits of the Reo, Peerless, Alco and Hewitt

Rovan truck with front wheel drive is the show novelty

Clutches and Their Application

DESCRIBING THE PRINCIPLE OF CLUTCHES, ILLUSTRATING DIFFERENT TYPES

THERE is no part of the power transmission group of more importance than the friction clutch commonly used to connect the engine with the driving wheels and this device is subject to more abuse in the performance of its duty than any other part of the mechanism.

The forms of clutches in common use in motor vehicles vary widely, and the fact that all are practical is best proved by their use in cars of established repute.

Frictional clutches may be divided into three broad classes; the cone, flat plate and band.

The most important consideration from a viewpoint of efficiency is that a clutch may be capable of transmitting the maximum power of the engine to which it is applied without slip or loss. Such a device must be easy to operate. In engaging, the power should be applied to the mechanism gradually or the resulting shock or jar will act injuriously upon it.

It is essential that the clutch disengage promptly and that there may be no drag or continued rotation of the parts after the clutch is disengaged. It must be of such design that the co-acting surfaces will operate for extended periods without material wear. It must be silent in operation, whether in engaging, in position, or releasing.

One point incidental to the multiple disc type of clutch is the compact design possible and the light weight of the driven member.

A type that has been very popular consists of a number of saw steel discs which may alternate with some of different material—probably phosphor bronze, one set of discs being driven by the engine while the remaining set is attached to the continuation of the transmission shaft. As is well known, it is the usual practice to enclose a clutch of this character in an oil-tight case, which ensures that the members will operates in a constant bath of lubricant, the object being to promote easy engagement and at the same time secure long life of the co-acting surfaces.

The advantages of this type as given by those who favor it are that the inertia of the driven member is very low because of its light weight and comparatively small diameter, and shifting of gears is possible without danger of clashing. Again, the spring pressure when the clutch is engaged must force out the film of lubricant which exists between the discs before a metal-to-metal contact will be obtained, allowing a certain amount of slip and enabling the power to be applied in a gradual manner.

It is true that the old film prevents harsh engagement in many instances, but it is also true that it acts as a binder, and the drag between the plates even when the pressure is released may be enough to produce spinning equal to that of any cone.

In later forms of multiple disc clutches, the use of cork inserts or asbestos has prevented an adhesion because of viscosity of oil film when pressure is relaxed, and has also reduced liability of injury from overheating but the application of these inserts in the conventional cone also eliminates many disadvantages. Examples of this will be found in the Premier clutch. There are 21 plates alternately placed, with cork inserts which prevent gripping. Small springs are placed between the driving members to facilitate disengagement.

There are forms of the multiple disc construction which employ three plates of large diameter to obtain sufficient frictional area, the form being as illustrated in the Thomas.

These clutches are very effective, and because of the amount of surface provided are not subject to much wear. They may or may not be run in oil at the option of the designer. They are very easy of engagement and will apply the power gradually. As in the case of the multiple disc clutch, the use of Cork Inserts or a special asbestos friction brake facing as in the case of the Ohio is all that makes this form thoroughly practical and enables it to transmit power without the use of excessive spring pressure to maintain frictional adhesion between the surfaces because of the increased friction which the cork affords.

Band clutches are practically the same in general principle of operation as band brakes but are divided into two classes: internal expanding, and external constricting. Clutches of the internal expanding type are in use on several of our best known motor cars. These forms often consist of a leather faced steel band or shoe expanding against the inner periphery of a drum which is usually integral with the flywheel.

Among the disadvantages of this form may be mentioned the difficulty in securing proper balance, and as it is necessary to increase the diameter to obtain the required contact surface, and, as in most forms a large proportion of the weight of the operating mechanism is carried at the rim, the condition of spinning which has been offered against the cone clutch will be equally applicable to this type.

The practical motorist is familiar with the work accomplished by the clutch and how it is interposed between the engine and the gear set of the motor. To most motorists the cone clutch is the best known of all types because of the period that it has been in use and the number of motor cars equipped with a device of that form.

The cone clutch is more bulky than any of the other forms with the exception of the three plate type, and perhaps an internal expanding band designed to transmit large powers. It is without doubt one of the simplest, its construction being understood by all. That it is easily engaged or released is obvious, and if properly constructed there will be no loss of power in transmission.

As is obvious, a cone clutch must be of large diameter if much power is to be transmitted. When the male member is released there has been considerable energy stored in the rim and its tendency is to continue revolving.

Admittedly, it is difficult to shift gears with the shafts in motion and, therefore, it is necessary to do one of two things: either wait until the momentum of the clutch becomes less, or follow the now usual practice and provide a brake to offer resistance to continued rotation. An example of this is shown in Fig. 2 as used on Overland cars. When the clutch is disengaged the male member touches the roller, which slows its momentum down sufficient to allow easy changing of the gears.

If one considers the other types of clutch critically it will be evident that in some of the latest forms, especially of the three plate or internal expanding band type, this factor of inertia of the driven member when released is of as much consequence as that of the cone form, and this disadvantage cannot be held as one met with only when conical clutches are employed. Even when the multiple disc clutch with plates of light construction and small diameter is used, there may be drag enough due to the fluid friction between the molecules of the lubricant to equal the condition of spinning produced by inertia in a heavier driven member.

Clutch Development

The early form of cone clutches were faced with leather secured to the outer periphery of the male members by means of rivets, and no means were provided to secure evenness of contact, with a result that the most careful operation was required

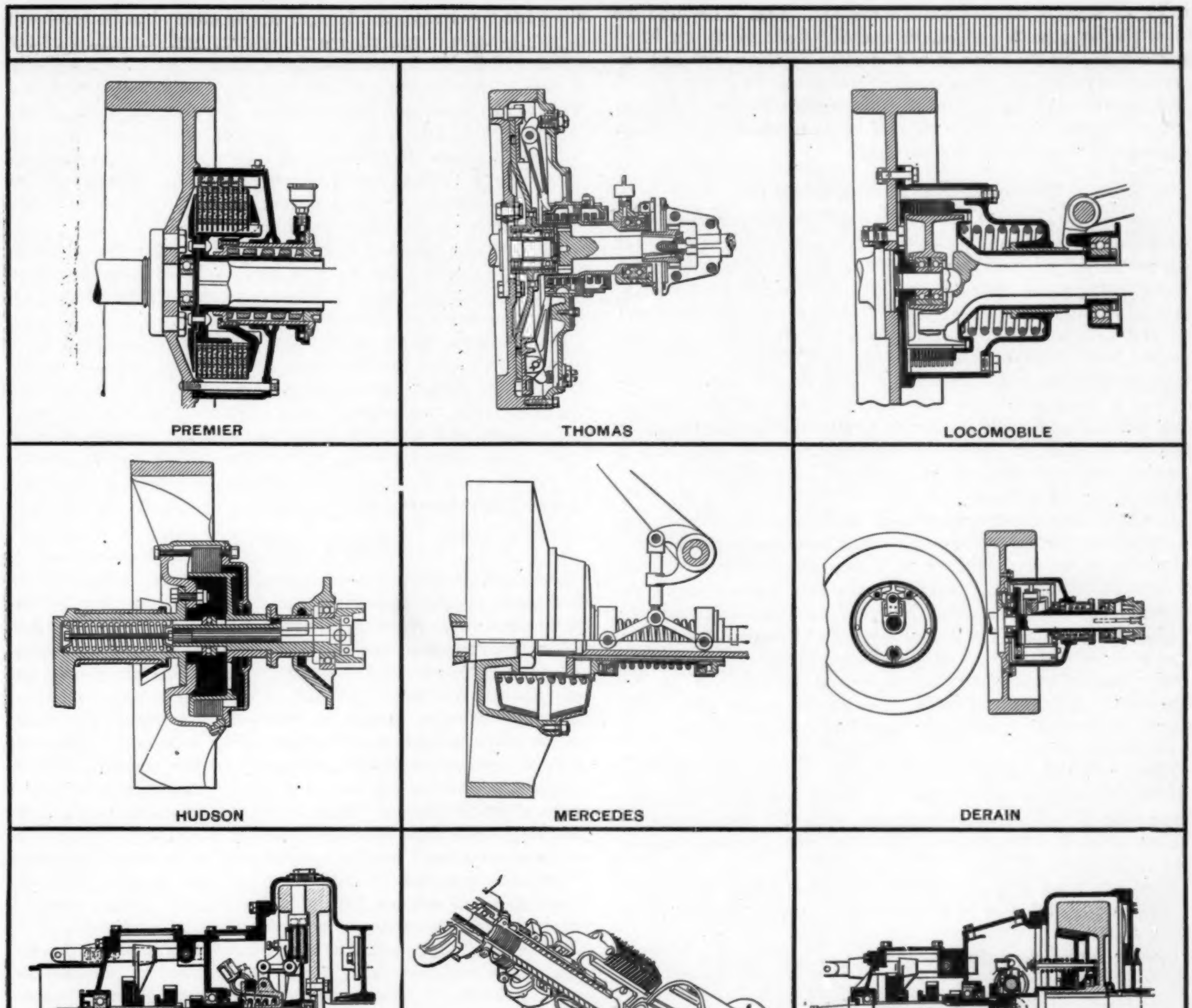


FIG. 1—ILLUSTRATING A DOZEN VARIOUS TYPES OF CLUTCHES ON FOREIGN AND AMERICAN CARS

to secure starting without considerable jar. That it required the most skillful attention to insure against harshness on one hand, and slipping on the other, is best attested by those who had experience with the old form of cone clutch and who were forced to consider other types in order to eliminate the disadvantages which now have been taken care of by more attention to design and materials employed in construction.

Securing Easy Engagement

In order to secure easy engagement certain engineers provided means by which the leather was raised at intervals around the periphery so that when the clutch was first engaged but a limited surface was presented for adhesion. When the full pressure of the spring was exerted the leather was depressed and the full area became in frictional contact. This means of preventing harsh engagement is used on the Cole clutch. Another means of arriving at the same end is used on the Cadillac and the foreign N. S. U. cars. The male member is made from a stamped steel part to which the leather is riveted in the usual manner which is turned thin enough to transmit the power and allow a certain amount of give and so reduce the gripping effect if the leather is on the dry side.

A still greater improvement made in cone clutch construction has been in the determination of the most satisfactory combinations of materials to use to obtain the maximum driving effect with minimum size, weight, spring pressure and harshness of engagement. The non-metallic frictional materials commonly employed as a facing for the male member in usual clutch construction are red fiber, leather, textile beltings, asbestos wire fabrics and composite surfaces composed of metal or of the non-metallic frictional materials above mentioned, in which cork inserts are embodied and form a material portion of the frictional area thereof.

Fiber, although having high coefficient of friction will char and become very brittle on the one hand, and is so hard and dense that it will in many instances wear the metal surfaces against which it is in contact on the other, and for these reasons is not now used.

Textile beltings and asbestos fabrics have proved very satisfactory in application to brakes, and have proved satisfactory in clutch service.

Leather forms the usual lining for cone clutches, but if used alone has disadvantages. It must not be allowed to became hard or dry because it will engage too quickly and the action of the clutch will be harsh, nor must it be allowed to become too oily as this will cause the surfaces to slip. If the clutch slips the leather will char, and when leather is either hard or glossy smooth it is of little value as a frictional medium, its degree of frictional adhesion decreasing in direct proportion as the material becomes less yielding, and a far greater spring pressure is required to maintain a proper degree of frictional contact when the leather is not in proper condition.

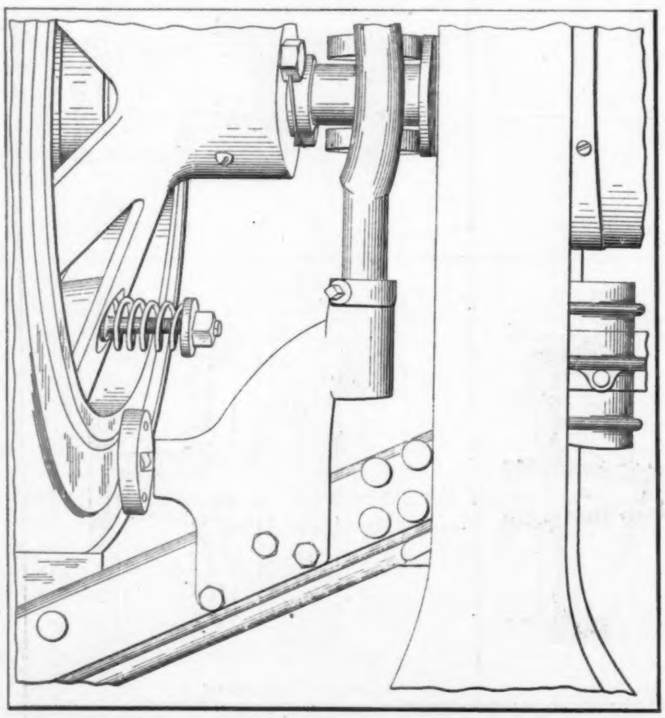


Fig. 2—Clutch brake as fitted to Overland cars to facilitate changing speed

A proper application of cork inserts will improve the operation of any clutch where they may be used, and that many designers are of this opinion is evident when one considers the number of applications made of this material in clutches.

The engineer, the mechanic and the practical motorist have all experienced the troubles which follow when the surfaces of the ordinary leather-faced cone become covered with oil, and as it is manifestly impossible to keep lubricant from the frictional surfaces, the fact that cork does not materially vary in holding power, even when the metal surface with which it is in contact is covered with oil, would be a sufficient advantage to warrant its adoption, even were there no gain in capacity through its use.

Angle of Cone

The angle of the cone will depend solely upon the coefficient of friction of the materials selected and the condition of the friction surfaces. When the surfaces are of cast iron and leather, and, as we have seen, the coefficient of friction may be as high as 0.30, it is best to allow for the grease and oil which finds its way upon the surfaces; it is safer to take 0.15 or 0.20 as the coefficient of friction, though if cork inserts are used the value may be taken at 0.30 or even higher. The coefficient of friction is the tangent of the angle of repose for the materials of the clutch, therefore for cast iron and leather the angle will be between 14 and 17 degrees. If cork inserts are used in combination with leather the angle may be reduced to 12 degrees. There is a point where the angle may be so small as to cause a wedging effect of the cone, and while it will be easy enough to bring into engagement it will be very difficult to disengage it without application of considerable pressure upon the releasing mechanism.

It has been suggested that empirical formulæ would be of value to the engineer which would consider dimensions such as diameter, width of face, angle of cone, degree of spring pressure, etc., but such data could not be made reliable unless it was definitely settled that all would adhere to one standard type of clutch. Allowing that all engineers deciding to use the cone clutch believed that cork and leather combination against a cast-iron surface was the ideal arrangement it would not be difficult to arrive at conclusions, or present formulæ which could be applied with success in designing a clutch for any power.

As must be obvious to those considering the subject, the capacity of a clutch is judged by its ability to transmit the entire power of the motor without loss, and therefore its proportions must be such that the clutch will be able to transmit more power than the motor to which it is applied will develop. A clutch which is proportioned so that it is barely equal to the requirements will slip at the critical period, and a substantial margin of safety should be provided.

The reason for this is that the torque of the motor will vary with the construction, and certain causes may be added which will temporarily increase the motor torque, such as flywheel effect. Then one must consider that the nature of the frictional surfaces will not remain constant; under some conditions they may be dry; then again oil will alter the coefficient of friction to some extent.

To present a definite set of formulæ which may be applied to design of the modern cone clutch, it will be well to review some of the principles of operation, which are very well shown in Fig. 3.

In this diagram a c is the axis of the clutch and abc is the angle of the cone. From any point, as c, erect a perpendicular

to c b. Then if ac represents the axial pressure forcing the cones together, ab is the resulting pressure acting in a direction perpendicular to the surface of the cone.

It has been aptly stated that the cone clutch is a development of the flat plate type. The most valuable point gained by coning is that it constitutes a simple method of converting the horizontal spring pressure into a very much greater pressure at the surface of the cone. The greater the angle of the cone, the more nearly the conditions approximate the flat plate type of clutch, and the greater the spring pressure required to maintain contact. At the other hand, angles of less than 10 degrees cause a wedging action and difficult release, which is not desirable, to say the least, regardless of the efficiency of transmission.

It will be then evident that the cone clutch is not of that form where a pound spring pressure means a pound pressure in maintaining contact between the surfaces, the purpose of the cone being to multiply or increase the value of the spring pressure by the lever advantage which is obtained. The amount of spring pressure required to maintain efficient frictional adhesion between the surfaces will vary with the coefficient of friction of the materials in contact, and the angle of the cone, as well as the horsepower to be transmitted. This is also limited by other considerations, such as the ability of the average operator to depress the pedal releasing the clutch. The average strong man can press with a pressure of from 75 to 100 pounds against a pedal with the foot, but as all are not of equal strength, and as the motor car is in many cases operated by youths and women, it will be well to consider 50 pounds an average of the pressure that one would care to exert against the pedal. The leverage effect can then be figured on this basis and if proportioned on a six to one relation of power to weight arm, this amount of pressure will be capable of releasing a 300-pound spring without undue exertion on the part of the operator or much strain on the operating parts.

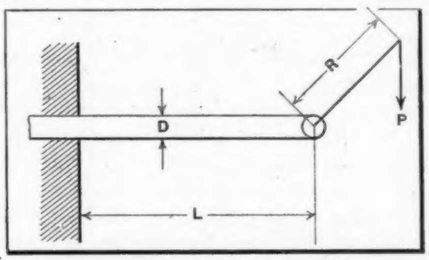


Fig. 4—Determining maximum deflection

Some Empirical Formulæ

In making calculations for friction clutches of any type it will be necessary to resolve the actual horsepower into torsional resistance at the rim of the clutch. If P represents the brake horsepower to be transmitted, R the revolutions per minute and M the twisting movements in foot pounds, we have:

$$M = \frac{P\ 33{,}000}{R\ 2\ W} \qquad (1)$$

which, after reducing may be expressed with sufficient accuracy for all ordinary purposes by the simpler equation:

$$M = \frac{5250\ P}{R} \qquad (2)$$

Now if we make F equal the mean radius of the clutch in feet and let S equal the torsional resistance, we have the expression:

$$S = \frac{M}{F} \qquad (3)$$

To facilitate calculations, it will be preferable to express the mean radius of the clutch in inches, doing which and substituting the value of M from equation 2 gives us:

$$S = \frac{63{,}000\ P}{F\ R} \qquad (4)$$

and no matter what design of clutch is being considered the equation 4 is applicable to it and remains unaltered.

Referring again to Fig. 3, if we call the axial pressure, represented by the line ac, x, and the resulting pressure, represented by the line ab, z, we have:

$$\frac{ab}{ac} = \frac{z}{x} = \frac{1}{\sin \text{angle}}$$

and if f be the coefficient of the materials employed, it is evident that to transmit the required power zf, or the product of the resulting pressure times the coefficient of friction of the materials must equal the torsional resistance, and it is best to allow a little more by considering the lowest coefficient obtained under actual conditions rather than the highest.

As the resulting pressure z is equal to the axial pressure divided by the sine of the angle abc we have:

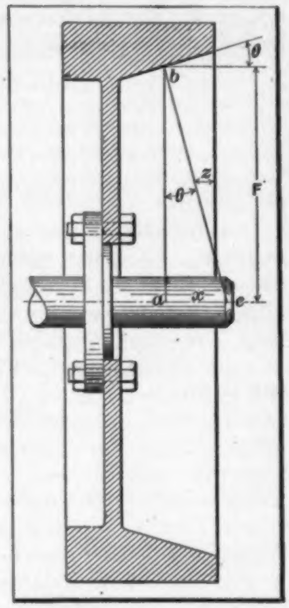


Fig. 3—Form of cone clutch, illustrating action

$S = cf$, which in turn should equal:

$$\frac{xf}{\sin \text{angle}}$$

and if we substitute the value of S from equation 4 we arrive at:

$$\frac{xf}{\sin \text{angle}} = \frac{63{,}000\ P}{F\ R}$$

Therefore, we have the following, formula 5, to determine spring pressure and 6 to arrive at the horsepower a clutch of known dimensions will transmit:

$$x = \frac{63{,}000\ P \sin \text{angle}}{f\ F\ R} \qquad (5)$$

$$P = \frac{x\ f\ F\ R}{63{,}000 \sin \text{angle}} \qquad (6)$$

In making calculations for multiple disc clutches the coefficient of friction of the plates is a very doubtful matter as it varies with the quality and viscosity of the oil used. However the horsepower that can be transmitted by one of these clutches can be found thus:

$$\text{H.P.} = \frac{2\pi r\ N \mu\ W\ (p - 1)}{33{,}000}$$

where r = the mean radius of the plates;
μ = coefficient of friction taken as 0.06;
W = load on clutch spring in pounds;
p = number of plates in clutch;
N = number of revolutions required for the horsepower;
or if the strength of the spring which will be suitable for a given horsepower is to be found the equation becomes

$$W = \frac{\text{H.P.} \times 33{,}000}{2\pi r\ \mu N\ (p - 1}$$

Carrying Capacity and Deflection of Helical Springs Made of Steel Wire

The following informations are given for every spring made of steel wire, with a fixed diameter D and a fixed thickness d:

1. Maximum carrying capacity.
2. Deflection at this load, provided the spring has 10 coils.
3. Value of c, the coefficient of stiffness.

Maximum Carrying Capacity

A simple torsional spring, which is prevented from shifting sideways, be exposed to the influence of a strain P, which acts on

a lever R. The greatest shearing strain t of the material is then known from the equation:

$$P\,R = \frac{Tt}{e}$$

T = polar moment of inertia of the wire section.

e = distance of the farthest fiber from the center of gravity in this section.

This formula is also correct for a helical spring with the radius R. The polar moment of inertia is twice the equatorial moment of inertia for the circular section:

$$T = 2\frac{\pi d^4}{64} = \frac{\pi d^4}{32}$$

and farther

$$e = \frac{d}{2} \text{ and } R = \frac{D}{2}.$$

If we insert these values, then we get

$$P = \frac{\pi}{8}\,\frac{d^3t}{D}$$

The maximum shearing strain of the material is taken to 64,000 pounds per square inch in the table. This high strain can be figured on, if good and hardened steel is used and if the load remains pretty constant, what has been provided by setting up the table. This point will be considered later.

If we put the value t = 64.000 in the formula for P, then we

$$P \text{ max.} = \frac{64{,}000\,\pi}{8}\,\frac{d^3}{D} = 25{,}120\,\frac{d^3}{D} \qquad (1)$$

D and d in inches, P in pounds.

Maximum Deflection

The angle of torsion for a simple torsional spring with the length L and under the influence of a strain P, which acts on a lever R (Fig. 4), is:

$$\alpha = \frac{P\,R}{G\,T}\,L$$

G is the modul of elasticity for shearing.

The same formula is also approximately correct for a helical spring. But the length is then 2 R π N and N is the number of coils. This value of L put in the formula for the angle of torsion gives:

$$\alpha = \frac{2\pi R^2 N}{G\,T}\,P$$

The strain P causes a deflection of the spring

$$\delta = R\,\alpha = \frac{2\pi R^3 N}{G\,T}\,P$$

For the circular section is

$$T = \frac{\pi d^4}{32} \text{ and } R = \frac{D}{2},$$

therefore

$$\delta = \frac{8\,D^3}{G\,d^4}\,P\,N$$

The modul of elasticity for shearing is taken to 10,660,000 pounds per square inch in the table, which is correct for good spring steel.

The formula for the deflection reads now as follows:

$$\delta = \frac{8\,D^3}{10{,}660{,}000\,d^4}\,P\,N = \frac{D^3}{1{,}332{,}500\,d^4}\,P\,N \qquad (2)$$

The value of P max. put in this formula gives:

$$\delta \text{ max.} = \frac{25{,}120}{1{,}332{,}500}\,\frac{D^2}{d}\,N = \frac{D^2N}{53\,d}$$

The maximum deflection for the different spring dimensions is given in the table, providing 10 coils for every spring. For such a spring with 10 coils is

$$\delta \text{ max.} = \frac{D^2}{53\,d}$$

Now it is easy to calculate the deflection of a corresponding spring with a different number of coils, since the deflection is proportional to the number of coils.

The formula 2 for the deflection of any helical spring with N coils can be written as follows:

$$\delta = \frac{P\,N}{32\,c}$$

$$\text{If } 32\,c = 1{,}332{,}500\,\frac{d^4}{D^3}$$

$$\text{and } c = 41{,}641\,\frac{d^4}{D^3}$$

The value of this coefficient c, which depends only upon the spring and wire diameter, gives a measure for the stiffness of the spring, because for springs with an equal number of coils and an equal load P is the deflection reversed proportional to this coefficient. The value of this coefficient can also be ascertained, and is very useful for comparing different springs with each other. If we put $\delta = 1\text{-}32$ and $N = 1$ in the formula $\delta = \frac{PN}{32c}$, so is $c = P$.

Thus the coefficient of stiffness gives us the power in pounds, which is necessary to bend each coil of a spring 1-32 inch.

The factor which determines the effective mean radius most is that of spinning and the diameter of a cone should not be allowed to exceed 16 or 18 inches unless a brake is provided to resist the rotation of the driven clutch member. Inertia is a factor of some moment in cone clutch design, and to keep this as low as possible it is best to keep the diameter of the cone within bounds and to provide for increased capacity by increasing the amount of spring pressure and amount of surface in contact, in preference to making larger the mean radius of the cone. Then again the size of the clutch is limited by the diameter of the flywheel, and as this should be kept within reason it is rare that the mean radius of a cone is greater than 10 inches.

The chief disadvantage of the cone clutch then appears to be the inertia of the driven member, and while in many instances this is due to natural causes, the spinning may be caused by derangement of parts. If the bearing on which the male member revolves runs dry and seizes it will continue to revolve, even when the spring pressure is released, as there will be friction enough between the shaft and the bearing to continue to drive the cone. A ball thrust bearing may become bound tightly because of a broken ball or particles of foreign matter, which will cause the spring to transmit the continued rotation of the female member.

A feature of import is that the clutch be so designed that these elements retain their perfect concentricity and so that perfect alignment of them may always be relied upon. If there is wear enough in the bearing of the male member it will not disengage promptly, as its weight may be sufficient to cause it to sag against the lower surface of the female member.

If spinning is caused by natural causes, and the diameter of the clutch must be large to transmit the power developed, it is comparatively easy to fit small frictional brakes and prevent continued rotation when the clutch is disengaged. It has been found necessary to fit brakes on some forms of three plate and even multiple disc clutches to prevent continued rotation of the driven members and there is no objection to so fitting a cone clutch, as the quietness of shifting the gears and the condition of the gear teeth after a season's use will amply prove the wisdom of such equipment, especially if there is any "spinning" tendency.

Questions That Arise

SOME OF THOSE THAT COME UP IN EVERY-DAY AUTOMOBILING ARE ANSWERED BY THE MATTER PRESENTED BY FORREST R. JONES IN THE NEW EDITION OF THE "AUTOMOBILE CATECHISM"

[364]—How can high-tension electricity, as used for motor ignition, be distinguished from low-tension electricity?

If the end of an insulated wire charged with high-tension electricity is held within a quarter of an inch or so from the metal of the motor, a spark will jump across the space between the end of the wire and the motor. If one's hand touches the metal of a charged high-tension wire, a startling shock will be received. The shock is not dangerous, however, unless continued for a considerable time.

Low-tension electricity will not jump across an air space. It will not give a shock except at the instant the contact points are separated to form an arc. The shock from low-tension electricity even then is not as strong as that from high-tension.

[365]—How should cup-and-cone ball bearings be adjusted when replacing a wheel?

So that the wheel will turn perfectly free. A little looseness is not objectionable. A tight bearing is apt to crush the balls or damage the ball race (cup or cone).

[366]—What are the indications of wear in a ball bearing?

The balls become rough by flaking off of the skin of the metal, and the same effect may be noticeable on the ball races. If the races are too soft they may groove without flaking.

[367]—When assembling a ball bearing that has no cage for retaining the balls in place, how can the balls be kept from falling out?

By using a liberal supply of grease or cement for holding them.

[368]—What is the remedy for a cut or seized plain journal bearing?

If it is a split bearing open it by removing the cap. Smooth the convex surface with a fine-cut file, or fine emery paper folded over a stick or file. Scrape the concave surface with a hard metal scraper or smooth it with emery paper. Large, hard lumps may be chipped off first with a cold chisel. Lubricate with a thin oil.

A solid bearing, or one difficult to open, can generally be worked free by oiling and turning, first slightly backward, then forward and so on.

[369]—If a journal bearing does not take lubricant well, what may be the cause?

The oil grooves in it may be filled with dirt, or the grooves may not be large enough or in the right place. Clean the grooves or give them the proper form and size.

[370]—How can the brakes be tested?

By running the car and applying them. They should cause the wheels to slip on the road when fully applied.

Another method is to lift the rear wheels free from the road or floor and run the motor with the gears set for low speed, then apply the brakes. This should stop the road wheels from rotating. It may or may not stop the motor, according to how tightly the friction clutch holds.

[371]—If a band—or strap—brake wears so that it will not grip the brake drum, how can it be adjusted?

There is usually an adjusting screw or rod connected to the band so that it can be tightened as wear occurs until the band or lining is worn out. Then a new lining must be fastened in. Rivets are very commonly used for attaching lining to shoe.

[372]—How do you adjust an expansion brake for wear?

An adjusting screw or bolt similar to that used for the band brake is generally provided for this purpose and used in a manner similar to that for band brake.

[373]—How would you adjust a pair of hub brakes which have no equalizing bar or other equalizing device?

Lift the wheels clear of the floor and adjust as judgment dictates by tightening the band or shoe of an external brake and expanding the shoe of an internal brake. Then start the engine and apply the hub brakes. If one brake is tighter than the other it will stop the rotation of its wheel while the other continues to move. By trial the shoes can be set so that they will hold both wheels equally well unless the brake mechanism is of a type which has the rod running back to one brake attached to or near the brake lever at one side of the car, while the other brake rod is operated by a shaft extending across the car and having a bell crank at the end. In such a case it is not possible to adjust the brakes so that they will hold both wheels with equal grips when the brake is applied with different degrees of force. In general the best setting is that which grips the wheel farthest from the brake lever and allows the other to rotate when the brake is lightly applied, but holds the one next the lever with the hardest grip as the brake is put on more forcibly. When there is an equalizing bar or similar device it is only necessary to adjust until the shoe or band fully grips the drum or cylinder, with some allowance for wear, and frees itself when the brake is released.

[374]—How are the brakes kept from overheating on long grades?

By cooling with water dropped on the drum or shoe, or both. The water is usually carried in a small tank for this purpose, and turned on as needed. A small pipe carries it from the tank to the brake drum.

[375]—Where is the timer attached to the four-cycle engine?

Very frequently to the camshaft (half-speed shaft, half-time shaft). A shaft or chain drive especially for the timer is also frequently used in order to bring it in an accessible position or where dirt and grit are not apt to accumulate on it, as well as for other reasons.

[376]—Should the timer always close the primary circuit when the piston is passing through the same position in its travel, whether the engine is rotating rapidly or slowly?

No. The primary circuit should be closed earlier in the cycle when engine runs rapidly than when running slowly.

In Beautiful Madeira

Seven Days From New York, Where Automobiles Are Ousting Ancient Conveyances

One of the familiar scenes in the beautiful Island of Madeira is the variety of public conveyances found in the city of Funchal, whose square overlooks the water. The vehicles consist of the carro, a funny-looking conveyance, not unlike a carriage that has been turned into a sleigh drawn by oxen; the rede, a small hammock supended from either end of a long pole with a canopy attached and borne on the shoulders of two stout natives, and the most modern of modern automobiles. These vehicles are arrayed side by side and their owners make a lively bid for the patronage of tourists. Madeira, the "Island of the Beautiful," is seven days from New York. Its inhabitants are nearly all Portuguese, but many of them speak the English language satisfactorily. The automobile bids fair to succeed the rede and the carro.

Fuel, Explosives and Detonators

THE INTERNAL COMBUSTION MOTOR IS DESCRIBED AS OF THE EXPLOSION TYPE, DESPITE THE FACT THAT EXPLOSIVES ARE NOT USED AS FUEL

THE phenomenon called combustion, or burning, is represented by the rapid chemical change or combination accompanied by heat and generally some light, during which heat is evolved in quantity to balance the energy required to separate the compounds into their elements.

If combustion is relatively slow, the compound is called a fuel.

If combustion is almost instantaneous, the compound is termed an explosive.

If a compound is self-sufficient, holding in its makeup enough oxygen to produce complete combustion, it will properly class as an explosive, due to the rate of combustion being high under such conditions.

If the compound is not self-sufficient it will properly class as a fuel, as a rule, due to the slow rate of combining of the oxygen of the air with the combustible material, but if pure oxygen is supplied under regulated conditions of pressure and temperature the compound may then take on nearly, if not all, of the characteristics of an explosive.

Some compounds, in addition to being explosives, have detonating properties, in other words, they will explode when shocked, or if the temperature at the atmospheric pressure is raised to some definite point, or this self-exploding point may be definitely established by raising the temperature and pressure combined.

Spontaneous combustion is another property that is peculiar to some compounds. This property may be present resulting in self-firing attended by slow burning, self-firing attended by rapid burning, self-firing attended by nearly instantaneous combustion, or detonation may be the last stage of this characteristic of the compound.

The conditions must be right to support combustion. Take a splinter of wood, for illustration, if it is dry and the temperature is raised to over 600 degrees centigrade, it will take fire and burn at a relatively slow rate, but if the splinter is wet, even if it is heated to the flaming point, say at one end, it may fail to support combustion, due to the fact that all the available heat will be absorbed in the boiling of the water, and in the process the temperature will fall to the boiling point of the water, *i. e.*, 212 degrees Fahrenheit, when the wood will fail to rekindle since its flaming point is about three times the boiling temperature of the water.

The crude illustration here offered of the quenching of the flame of the wood by the boiling of the water is capable of explaining what transpires to a greater or lesser degree in all burning processes. If it is desired to burn gasoline, for illustration, the presence of liquid gasoline in the mixture of vapor of gasoline and atmospheric air tends to quench the flame at a rate considerably below the quenching effect of water, but sufficiently intense, however, to be a large factor.

There is one principle here that brings gasoline into a different class from water as a quenching medium. Water is not a fuel; gasoline is a fuel. If gasoline is present in liquid form, while it acts as a quenching medium at the rate of 0.5 British thermal units per pound, it also feeds fuel to the flame in proportion to the thermal value of its fuel property, and if air is present in quantity sufficient to satisfy the conditions of burning, the gasoline will support continued combustion.

But these are all details of more than a little interest to the man desirous to become quite familiar with thermo-dynamic relations in a gasoline motor. It will be seen at once why there may be too much gasoline fed to the motor. The excess tends to quench the fire. The rate of burning is reduced and the wave of pressure in addition to being reduced, as measured in pounds per square inch at the peak of the wave, is retarded so that the terminal pressure is also retarded, and it issues to the atmosphere with an excess of fuel value in its composition, thus reducing the thermal efficiency of the motor.

If it is understood that fuel is that class of compounds that will not burn even when heated, put under pressure or subjected to shock in the absence of an outside supply of oxygen, it will be understood that fuel is a safe compound to handle, store and use. A simple fuel in gas form is CH_4 or marsh gas. When this fuel is burned the product of combustion is water and carbon dioxide. The formula of combustion is:

$CH_4 + 2O_2 = CO_2 + 2H_2O$ = marsh gas + oxygen = carbon dioxide + water

But marsh gas is not a good fuel to use in motors. It is normal in gas form. The space required for its storage would be very great. In order to overcome this difficulty it is necessary to use a more concentrated form of fuel. Liquid fuel is more concentrated than gas. Instead of $C\,H_4$ (marsh gas) $C_6\,H_4$ (hexane) is used. The intervening combination $C_4\,H_{10}$ is in liquid form under normal conditions, but it is just on the borderland of the gas form all the time, and it is very scarce also.

In dealing with the various compounds it is necessary to investigate their calorific (fuel value) and acceptability which latter property depends upon volatility, vapor tension, ratio of carbon to hydrogen, latent heat of evaporation, specific heat, boiling point, etc., all of which, in addition to behavior as fuel, with the idea of guarding against explosion and detonating characteristics.

The calorific of a fuel is found, according to Dulong's formula, as follows:

$$\text{B. T. U. per pound} = 14{,}600C + 62{,}000\left(H. - \frac{O}{8}\right) + 4{,}000\,S.$$

When:

C=carbon;

H=hydrogen;

O=oxygen, and

S=sulphur (inactive elements)

But this formula applies to coal with greater facility than to other fuels, and it is necessary to have an analysis of the fuel in any case.

In a general way it may be pointed out that:

The calorific of carbon is 14,600.

The calorific of hydrogen is 62,000.

Referring back now to marsh gas (C H4) this compound is comprised of (per pound) 3-4 pound of carbon, and 1-4 pound of hydrogen, and it follows therefore, that:

0.75C+0=14,600×0.75=10,950 B. T. U.

0.25H+0=62,000×0.25=15,500 B. T. U.

Total.................. 26,450 B. T. U.

From this computation it is discernable that hydrogen is a very valuable fuel, and it may be inferred as well, that the ratio of hydrogen to carbon in a fuel is a very important item.

In the above computation the atomic weights of carbon (C), hydrogen (H), and oxygen (O), were taken as:

C=12; H=1, and O=16.

On this basis for marsh gas, (C H4):

(12+4)+2 (16×2)=[12+(16×2)]+2 (2+16).

i. e., 16 lbs.+64 lbs.=44 lbs.+36 lbs.

or 1 lb.+4 lbs. yields 2.75 lbs.+2.25 lbs.

and 1+4=5 also 2.75+2.25=5, and 5−5=0=complete combustion.

The weight of the various gases in grams per liter is authoritively stated as follows:

TABULATION OF WEIGHTS OF GASES

Formula	Name	Grams per liter
H	Hydrogen	0.0895
O	Oxygen	1.430
N	Nitrogen	1.257
4NO	Air	1.293
CO	Carbon Monoxide	1.251
CO_2	Carbon Dioxide	1.966
CH_4	Methane	0.7155
C_2H_4	Ethylene	1.252

The composition of air is as follows:

COMPOSITION OF AIR BY VOLUME AND WEIGHT

Contents	By volume per cent.	By weight per cent.
O	20.92	23.134
N	79.08	76.866

Accordingly 4.78 volumes of air contain one of oxygen; or one volume of oxygen is accompanied by 3.78 volumes of nitrogen.

In considering the quenching effect of the various gases, in other words the amount of heat required to raise the temperature of the gases from the low point at which they enter the combustion chamber of a motor to the high point to which they have to be raised at the expense of some of the energy of the fuel, it is necessary to take into account the specific heat of the various gases employed, which is authoritively stated as follows:

SPECIFIC HEAT VALUES OF THE ELEMENTS AND COMPOUNDS OF GASES

Formula	Name	Specific heat
H	Hydrogen	3.4
O	Oxygen	0.22
N	Nitrogen	0.24
4NO	Air	0.24
CO	Carbon Monoxide	0.25
CO_2	Carbon Dioxide	0.22
CH_4	Methane	0.60

In connection with the specific heat values of these elements and compounds, it remains to keep in mind the fact that carbon and hydrogen and the compounds of carbon and hydrogen are the elements and compounds that evolve energy during combustion. These elements and compounds therefore, are capable of raising the temperature on a self-sustaining basis, but some of the energy given off by them is dissipated in the process of elevating their temperatures. Referring to carbon monoxide it is of course true that much of the carbon is in an incomplete state of combustion, but it is unfortunate that this product indicates that the fuel has not been completely burned out, it ranks as a waste. Carbon dioxide, on the other hand, is in a state of finality, there being no further fuel value present. Nitrogen is inert but it serves as a retarding element, thus preventing automobile fuel from ranking as an explosive, or a detonator, as the case may be. The oxygen representing 20.92 per cent., by volume of the air, seems to be present in quantity sufficient to accomplish the intended purpose so that the nitrogen representing 79.08 of the air is valuable, although it has no fuel value.

Since nitrogen serves as the retarding influence, and there is always enough of it present to serve for this purpose, any further acquisitions of inert gas, as the spent products of combustion, should be regarded as detrimental, and it is for this reason that scavenging is an extremely important process in the cyclic relations of an internal combustion motor. Scavenging represents a variable situation, and were dependence to be placed upon the inert products of combustion it would be necessary to find out how to fix them at some constant level, and this is impossible by any process that we now know.

Personal and Car Safety Study

CONSIDERING A CERTAIN JUDICIAL ATTITUDE OF THE DRIVER SUPPLEMENTED BY ADEQUATE FACILITIES FROM THE POINT OF VIEW OF SAFETY ON THE ROAD

Fig. 8—Form of tungsten lamp used for limousine (interior) lighting

POPULAR conception has it that a large and powerful touring car is a terrible thing to encounter and that a little runabout is quite harmless, but the same judgment when it is applied to a five-ton truck, equipped with a furniture body and all the other evidences of size, charges it too with being in the class with railway locomotives, and entitled to distinction of a wide berth. Obviously this reasoning is defective. It cannot be true that the large and powerful touring car with its high speed represents a great road hazard, if it is proper to say that the five-ton truck attended by conditions of slow speed is difficult to control.

Looking at the whole matter from a rational point of view, it is necessary to take into account the fact that the energy stored in the mass as it compares with the ability of the tires to adhere to the road bed may be in the same ratio in the case of the large and powerful touring car as it is with a heavily loaded five-ton truck, and as it would be with a little runabout, and, for that matter, a horse and wagon, a motorcycle, and a bicycle struggles under the same law.

It was only the other day that a young and foolish greyhound broke into a gymnasium and, not liking the looks of a cannon ball which he espied at the other end of the room, he made a mad dash across the waxed and polished floor, hoping to frighten the cannon ball, which was resting peacably at the other end of the room; but the grey-hound had never been on a waxed and polished floor before, and his experience was limited to chasing around on the surface of Mother Earth, which taught him that he could stop within his own length whenever he so

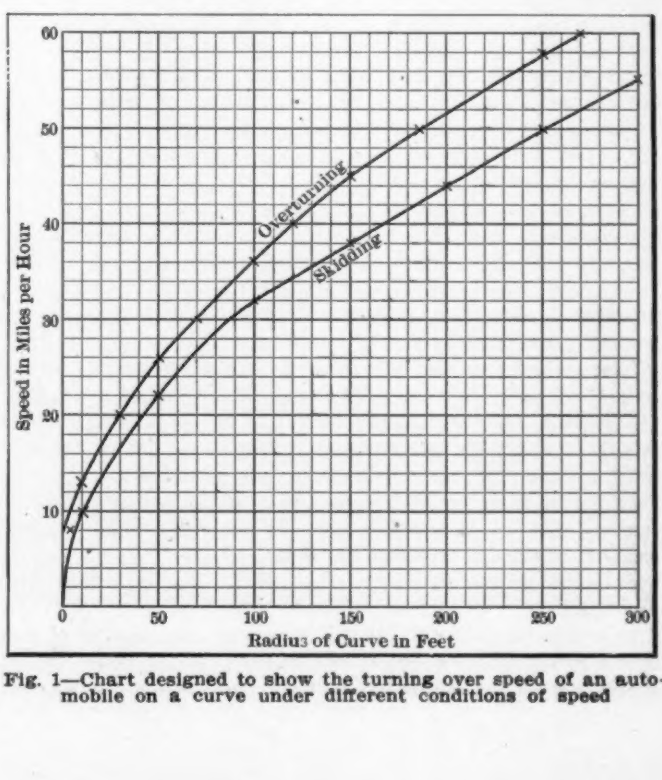


Fig. 1—Chart designed to show the turning over speed of an automobile on a curve under different conditions of speed

desired, but when he put the brakes on within the gymnasium he must have discovered when it was too late that there was a very poor relation between the pads of his spindle paws and the waxed floor, for instead of stopping, as he thought he would, he shot across the remaining distance at a speed which would do justice to a Twentieth Century Limited, and fetched up against an arbitrary and stubborn wall. The poor grey-hound was counted out, and when he came to, a matter of twenty minutes later, he was able to recount, if his reasoning power would permit, the same experience that the automobilist of grey-hound judgment has on the road when he overlooks the fact that Nature's laws are made for all, and that the energy stored in a moving mass is proportional to:

$$F - WV^2$$

The best way to bring out the effect of energy stored in the moving mass is to take an automobile out on the road and find a turn with a short radius and, starting with a low speed, make repeated trials, increasing the speed by relatively small increments, tapering them off as the speed is increased, when it will be found that the automobile will skid a little at first, and violently thereafter if the speed is increased but slightly. It is almost a matter of no moment as to the type of automobile that is used in a trial such as this, due to the fact that skidding takes place for reasons that are substantially indepenedent of the size of the car.

In estimating the safe speed on a curve the computations are invariably clouded, due to the fact that the automobile tends to turn over as well as to skid, and if the speed of the car is increased to a point beyond that indicated by stability, it will either skid or turn over. Sometimes the skidding serves as a safety valve, so to say, because when the car is skidding, the energy stored in the moving mass is being dissipated, and it takes very little of this skidding effect to absorb so much of the stored energy that the amount present quickly falls below the quantity sufficient to cause the automobile to turn over. Referring to Fig. 1 of a curve plotted, first to show the skidding speed at different radii, and second to show the turning over speed at various conditions of radii, it will be seen that skidding is a primary condition, and this justifies the contention that if an automobile after it reaches the skidding speed fails to skid due to superior tractive conditions, it will turn over. The curve is plotted with radii of curvature as ordinates, and the speed in miles per hour as abscissa. Taking a curve with a radius of 100 feet, the skidding speed is shown as 32 miles per hour, and the turning over speed is shown as 36.1 miles per hour. In this case, the difference between the skidding speed and the turning over speed, as will be observed, is slightly more than four miles per hour.

If it may be assumed that the chart, Fig. 1, is correctly plotted, that is to say, if the principle involved is accurate, there is nothing shown on the chart that will tell the automobilist that the law will influence the performance of a big touring car any differently from the influence which will be brought to bear upon a little runabout. The chart is plotted for radii up to 200 feet, and for speeds up to 60 miles per hour, thus giving a sufficiently wide range of vision to tell the relatively inexperienced automobilist all about the effect of increasing speed. But charts are a little difficult for those who have not studied graphics, and a little comparison here should serve a useful purpose. Taking various radii, the following relations will hold:

RELATION OF RADIUS OF CURVATURE, SPEED IN MILES PER HOUR, SKIDDING, AND TURNING OVER POINT

Radius of Curve in feet	Speed in miles per hour Skidding	Turning over
50	22	26
100	32	36.1
150	38.1	45.6
200	44	51.8
250	50	55.8
300	55.5	...

These figures show that increasing the radius of the curve adds materially to the safety of the automobilist in driving on account of the increasing of the distance between skidding and turning over. When the radius of the curve is very short, the skidding and turning over speeds are quite close to each other, so that there is little opportunity to dissipate the energy stored in the moving mass, that is to say in the car, by skidding before the turning over point is reached. With the higher speeds, and increased radius of curvature, skidding takes place at a longer interval before the turning over critical point is reached, and what happens in practice is that the energy stored in the moving mass is dissipated by skidding, unless it happens that the car strikes an abrupt obstruction during the skidding period, when it might turn over as a result of the abrupt arrest of motion, aided by the remaining energy stored in the moving mass.

In racing work, if what has been said is true, there is not the measure of danger to be encountered that accords with popular conception, and while racing drivers do take risks under certain conditions, the fact remains that very few of them would be willing to risk their necks on a basis to match up with the idea that the average spectator harbors. The real danger comes to the man who is moping along an unknown road in the dark, nor does it matter whether or not the automobile doing service is large or small, with much or little power. There are all sorts of conditions on the road and as Fig. 1 shows, it is possible to reach the skidding point with a car at any speed from two or three miles per hour up to a mile in a minute.

It is even strange, in a way, that the greatest danger lies at the lower range of speeds so that when a little runabout is going along the road in the dark, and the driver is suddenly confronted by the necessity of making a sharp turn, he encounters one of two eminent dangers in either case, the first of which is skidding, and the second follows close on its heels in the form of turning over. The car will undoubtedly skid first,

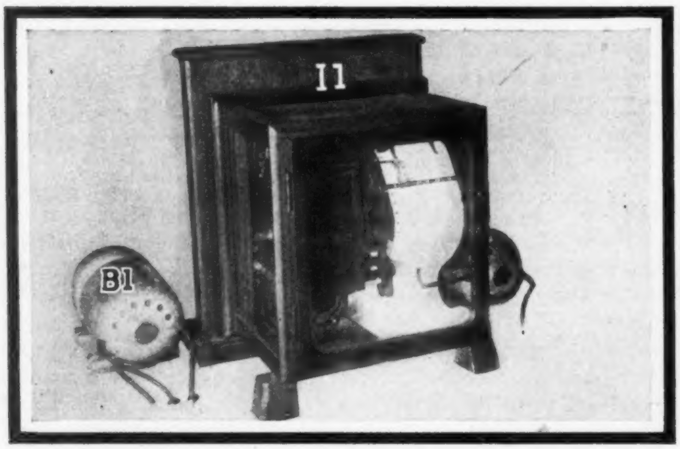


Fig. 2—Testing equipment shown by Gray & Davis to illustrate the constant voltage of the dynamo used for lighting work

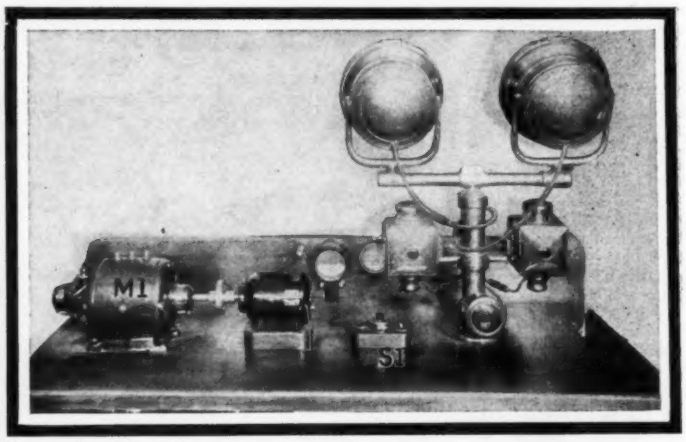


Fig. 4—Gray & Davis exhibit of a lighting dynamo driven by an electric motor with means for varying the speed

if the roadbed is slippery, but if the roadbed is firm the chances are that the turning over critical point will be reached concomitant with skidding.

Remembering that it is the function of the motor to propel the automobile, and that the brakes are relied upon to arrest the motion of the car, it still remains to appreciate the fact that motion cannot be arrested excepting by the process that will result in the dissipation of all the energy that is stored in the moving mass. The brakes when used are for the purpose of dissipating this energy, but they are limited in their ability in this regard in two ways. The first limitation is brought about by the limited adhesion of the tires to the roadbed, and the second limitation is in connection with the ability of the brake-shoes as they press against the surfaces of the brake-drum. A considerable time element must intervene in braking, due to the fact that the energy stored in the moving mass is proportional to WV^2, but the ability of the brakes is proportional to:

$A = 2\pi$ R S P.

When,

A=Ability.

$2\pi = 6.28$

R=Radius (in feet) of the brake drum.

S=Angular velocity in revolutions per minute.

P=Pressure in pounds exerted by the brake-shoes.

A study of the energy storage formula parallel with a study of the braking ability formula discloses the fact that if the speed of an automobile is doubled, the distance required to arrest motion will be multiplied by 4. This is as much as to say that if the motion of a car can be arrested by application of the brakes from a speed of 20 miles per hour to zero within a distance of 40 feet, it will take four times 40 or 160 feet to arrest the motion of the car if the speed is increased to 40 miles per hour. It does not follow that the motion of a car can be brought to zero within 40 feet from a speed of 20 miles per hour.

When an automobilist is confronted by the necessity of either stopping his car or making a sharp turn at an unsafe speed, if he is working in broad daylight his judgment is worth something, and he is enabled to extract himself from a tight corner, utilizing his possibilities as follows:

(a)—Brakes may be applied following dictates of judgment.

(b)—The automobile may be steered in such a way as to avoid obstructions, and to maintain a state of equilibruim offsetting the tendency of the car to turn over.

(c)—The radius of turning may be varied within the limits allowed by the width of the roadbed, thus helping materially to keep the car from turning over, and allowing more time for the brakes to absorb the energy stored in the moving mass.

But in the dark of night, judgment is supplanted by fear, and the control of the automobile is abandoned to Nature's laws under the most unfavorable conditions, so that danger resides in blind driving at speeds far below the velocities that might be attained with relative safety when the judgment of the driver is not handicapped by inability to see, and fear of the unseen.

It is not customary in the literature of the day to attribute to good lighting facilities anything but the pleasure it gives the owner of the automobile to view the scenery by a process of squinting along the beam of light as it is projected from the lens of a lamp, anticipating the time when the rays of light will be projected against objects ahead, bringing them into bold relief, thus affording mental food for the engaged automobilist who is also of that peculiar turn of mind which will permit him to forego the pleasure of surprise should the light fail to pick up interesting objects by the roadside, or should the lighting facilities be so poor that they would be lacking in ability to play their part in this kaleidoscopic setting.

That there are pleasurable conditions attending good lighting is not to be denied, but in the logic of things, lighting comes first as a necessity in the night time, and good brakes are of secondary importance. This is true, due to the fact that the motion of an automobile cannot be arrested within a certain distance, brakes or no brakes, and in order to be able to utilize

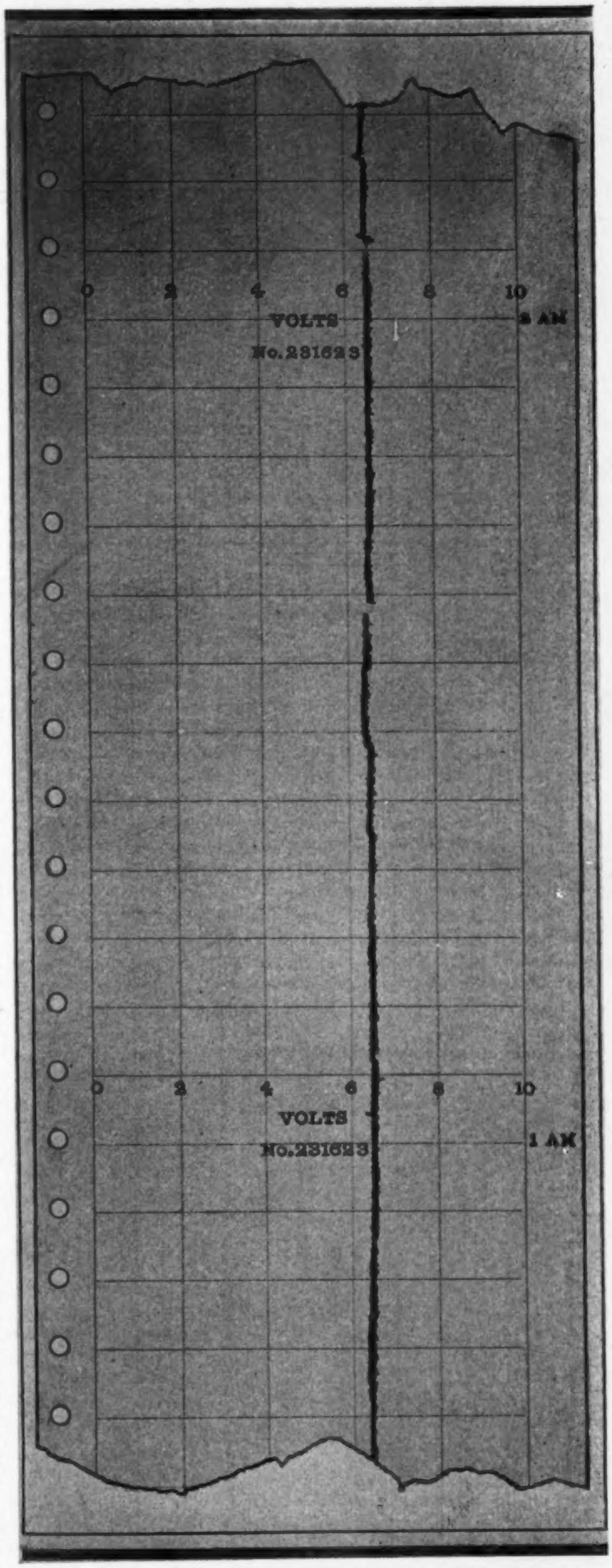


Fig. 3—Chart taken from the recording volt meter used in the Gray & Davis exhibit at the Garden, as shown in Fig. 2. The line shows that the voltage remained substantially constant during the time indicated, notwithstanding speed variations in the driving motor of more than 1,000 revolutions

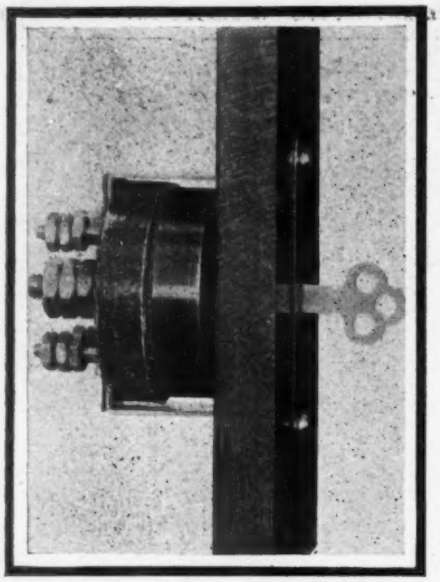


Fig. 5—Electric lighting switch made by the General Electric Company for automobile work

the brakes at all on a basis of safety, it is either necessary to limit the speed of the automobile to a very low point or employ lamps so good that they will show the way for a sufficient distance ahead to enable the automobile to be brought to rest by means of the brakes if the occasion requires it.

Force of habit is a power for safety if the habit is one that induces automatic action in time of danger. But force of habit is the most potent road to a calamity under certain conditions. The automobilist who is accustomed to driving at night under the beguiling wiles of a good set of lamps, unconsciously learns how to drive at relatively high speeds, and if the lamps fail in some important particular, and the lighting becomes dim and uncertain, the automobilist through force of habit will continue to drive at the high speed that he learned under conditions of good lighting, and he will be in imminent danger during all this period of time; moreover, other users of the highway will be in far greater danger than that which falls to the lot of the automobilist, also as the result of force of habit, since the public learns in the course of time that its interests are being conserved by those who use the highway, and an approaching occupant of the road would not know of the condition attending the approaching car with a driver who has learned how fast he can go with safety if the lighting is good, but who, for the time, is making this same high speed under lighting conditions which are not good. Summing up from this point of view, there is grave danger attending the use of lamps that do good lighting work for part of the time, and fall below the level of their standard of illumination for the remaining part of the time. It would be far better to confine lighting to a pair of kerosene oil lamps because they are reliable in the main than to employ a 20-inch searchlight if the latter has the bad taste to go out just when it is needed the most.

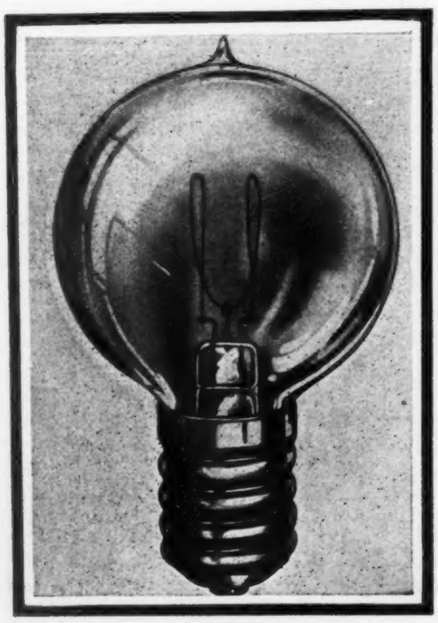


Fig. 6—Tungsten lamp of the spherical bulb type, made in 2, 4 and 5-candlepower sizes by the General Electric Company.

From the early days of the automobile in its present form the patrons of the industry were wont to point out the advantages of electric lighting; their experience with this ample form of illumination has been agreeable and satisfactory from the earliest days of the art, and to whatever extent electric lighting solved the problem of general illumination work, it brought adherence, so that when automobile lighting became a grave necessity, these disciples refused to down despite the fact that there were many obstacles in the way, and for a time it looked as though they would resist solving.

Primary attempts at solving the lighting problem were made with storage batteries and incandescent lamps of small candlepower and, it is regrettable to say, low efficiency. The art of building incandescent lamps ten years ago, however much it seemed to be perfected at that time, was crude as compared with the results that are being obtained now that tungsten and other rare alloys are being used advantageously.

To properly understand the advances that have been made in lamps it will be necessary to point out that lamp efficiency is measured in watts per candle, and in the olden days of the lamp business, 3.5 watts per candle was looked upon as a very good efficiency, which was only to be realized in connection with lamps that were short in the run of their life. The more rugged types of lamps in the early days required 4 watts per candle, and remembering that a horsepower is equal to 746 watts, it may readily be seen that a battery if used as the source of electricity in lighting would have to be a very large one to serve the purpose on a basis of satisfaction. This point is more clearly brought out if it may be said that batteries during this early period of the lighting struggle had an energy efficiency of about 4 watts per pound, which is another way for saying that for every hour a 16-candle power incandescent lamp was kept burning one pound of battery would have to be available and it, too, would have to be in prime condition.

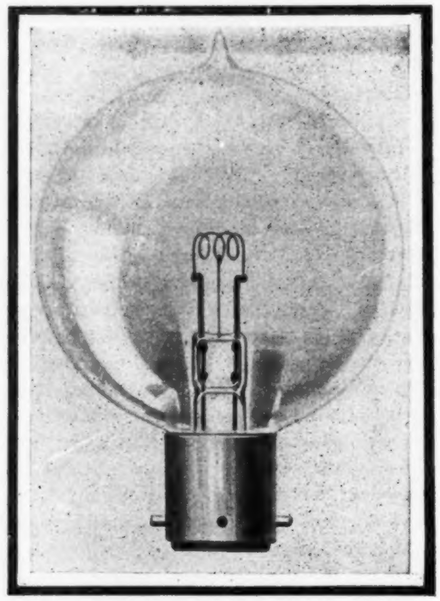


Fig. 7—Form of 10, 12 and 16-candlepower lamp used for automobile headlights

But batteries were hard to keep in prime condition in the days of low efficiency lamps, and it is fortunate that improvements in batteries were made simultaneously with improvements wrought in lamps, so that the better results of the present time when batteries are employed in lighting are due to a two-fold advantage as measured by batteries which will give at least 8 watts per pound instead of 4 as in the earlier efforts, and lamps that require barely one-third of the energy that attended the use of the older forms of incandescent lamps.

But even with the highly efficient tungsten lamps, illustrations of which are given here, and granting the use of modern batteries the fact remains that the battery must be charged from time to time and a large percentage of automobilists use their cars in districts remote from charging stations; it also happens to be true that while a battery is being charged another one must be substituted in its stead or the whole automobile must be laid up until the recharged battery is brought back and connected up.

It would be the claim of the novice that the mere charging of a battery is a matter of a few hours and that it could be done in the daytime so that the lighting facilities would be in good order by the coming of the shades of night, but this is not true.

If a battery is kept in constant service where it is charged and discharged regularly perhaps once a day, or once in two or three days at the outside, it may be recharged regularly within a few hours. If the battery is of the lead-lead type and it is doing daily service, receiving its recharge promptly upon discharge, the time required in the charging process will be as follows:

TIME REQUIRED TO CHARGE LEAD-LEAD BATTERIES

Hours	Per cent. of full charge
8	100
3	75
1	50
10 minutes	25

The above information is approximate, and in a general way true under fine conditions of operation, but when a battery is used for lighting under automobile conditions it is charged and then the discharge takes place slowly over a period of time with the result that a condition of sulphation intervenes, the nature of which is so persistent that the recharging effort will be futile unless the rate of recharging is slow and extended over even 20 or 30 hours instead of from 8 hours to less than 1 hour. It is also proper to say that the chances of deterioration of the battery are relatively great under lighting conditions, so that automobile engineers hav struggled with the solution of this great problem along entirely different lines from those involving the battery alone as the source of electricity. and when they recognize the absolute necessity of employing a charging dynamo floating the battery on the circuit, it only remains to find out how to build the dynamo so that it would be a constant source of supply, notwithstanding the fact that the dynamo would have to operate under speed changing conditions, taking power from the gasoline motor that drives the automobile, remembering that motor speed varies over a wide range in response to the needs of the car.

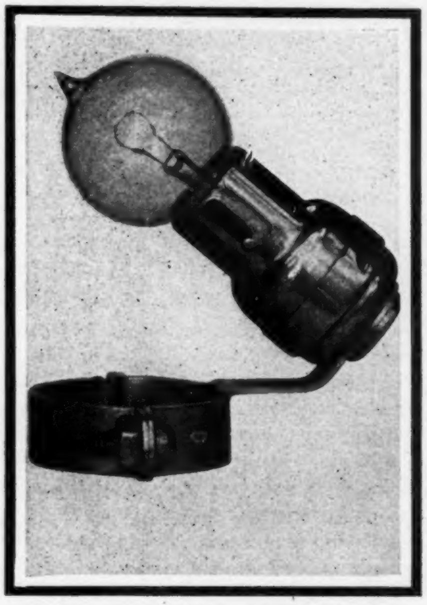


Fig. 9—Tungsten lamp and fixture designed to convert oil lamps to the electric type

It has always been difficult to design dynamo electric machines so that they deliver a variable current at a constant voltage, even when the dynamo operates at a constant speed. But if the dynamo is driven at a variable speed, as it must be in automobile work, the choice of the designer is very limited indeed, it being the case that "differential" compounding has long been regarded as far from efficacious for the purpose of making the dynamo deliver a variable current at a constant voltage under conditions of varying speeds. This plan was tried out at great length upwards of 20 years ago in connection with windmill power for lighting country houses, and it was found that the differential winding of the dynamo failed of its purpose, excepting within narrow limits.

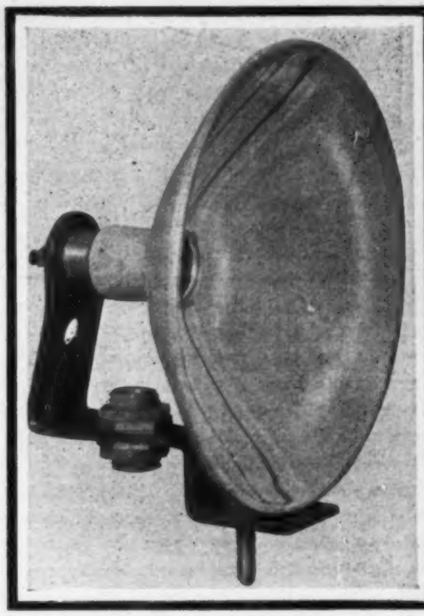


Fig. 10—Reflector and lamp combined, to be used in refitting gas headlights for electric lighting

Compound wound dynamos are capable of delivering a variable current at a constant voltage if the speed is constant, but these dynamos are not suited for use in charging batteries, and final choice fell upon types of shunt-wound dynamos with means for regulating the speed of the armature of the dynamo, notwithstanding the fact that the speed of the motive power, in other words the speed of the motor which drives the automobile, is a variable of the first magnitude.

As a working illustration of modern methods, reference may be had to Fig. 2 showing the Gray & Davis dynamo B1 and the instrument I1 by means of which measurements of the voltage are taken showing how constantly the voltage holds to the desired point, notwithstanding a wide variation in the speed at which the dynamo is driven, taking its power from the automobile motor. Fig. 3 is a reproduction of a short length of the chart as it was taken from the testing machine by the writer, and the line L1 shows that the voltage remained substantially constant during the hours marked on the chart, notwithstanding speed variations of more than 1,000 revolutions of the speed of the driving motor, which variations were brought about by altering the resistance which was used in the form of a rheostat connected in series with the field winding of the electric

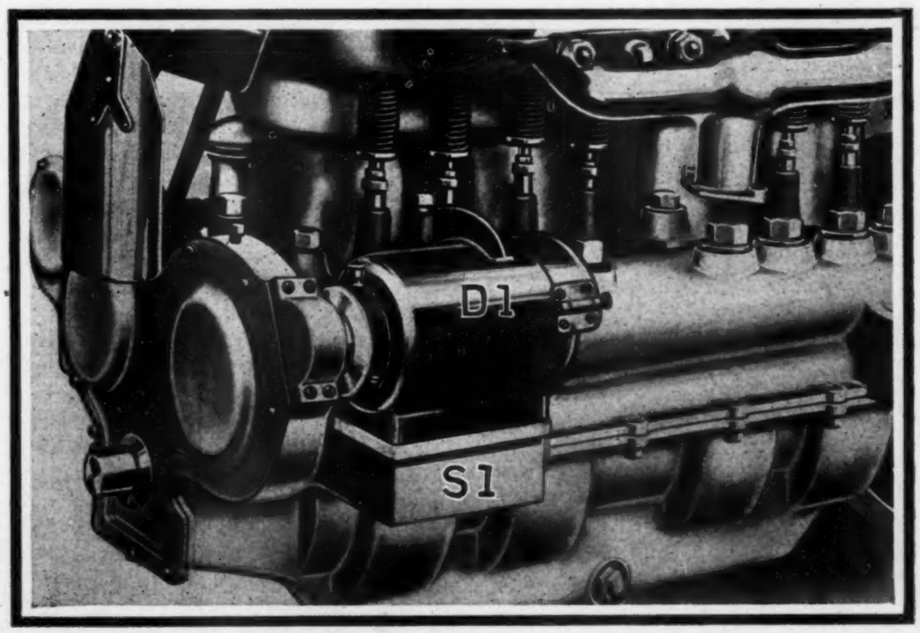


Fig. 11—"Aplco" dynamo as used for automobile electric lighting

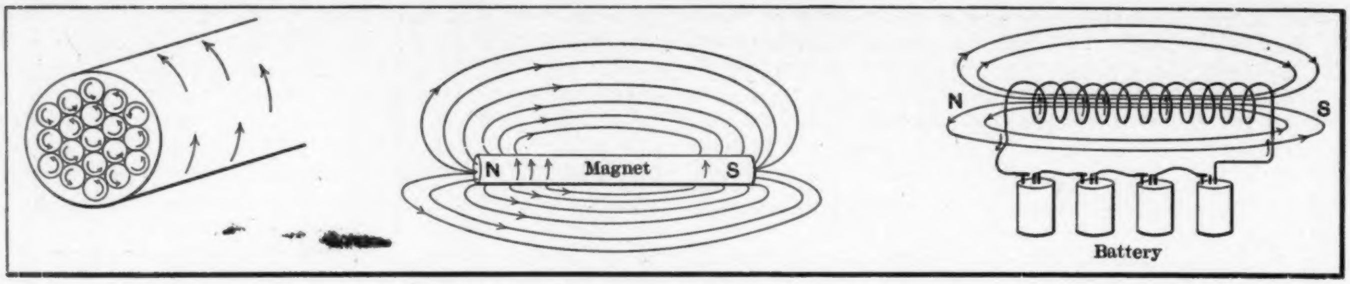


Fig. 12—Three wax drawings of a simple electro-magnetic system used to show the workings of a magneto

motor that was used in the test for the purpose of showing that the means for regulation incorporated in the dynamo were sufficient for the purpose, and referring again to Fig. 2 and to the dynamo D1, it will be observed that it is of small size and symmetrical design, capable of being placed alongside of the automobile motor under the bonnet, and that it is enclosed including the regulating device, so that foreign matter cannot get in and damage the working parts.

Referring to Fig. 4 of the dynamo as it was exhibited at Madison Square Garden and later at the National show at Chicago, the power was derived from an electric motor M1, and speed changes were made by adjusting the rheostat R1 which is shown fastened to the under side of the bench. The circuit is closed by the switch S1 and the rate of flow of the current is shown on an ampere meter that is used in connection with the test set. The constant voltage condition is determined by the recording meter as illustrated in Fig. 2.

There was one point that was clearly brought out in manipulating the test set at the shows, i. e., it is quite an advantage to be able to turn out the lights, or part of them at will; frequently, when a car is traversing a road with all lights burning, the need, temporarily, for less light, or a variation of effect, is experienced, and with a properly equipped system, including suitably disposed switches, all that has to be done is to cut out the head lights, for illustration, and depend upon the side lights for the illumination. Switches are to be had of a character that will lend facility to this plan, and the certainty with which the lights may be turned off and on is one of the points that is being made for electric lighting at the present time.

Accessories to Lighting Worked Out

One of the forms of switches that is being used in the control of the electric lights of an automobile is shown in Fig. 5, of a key fitted to the hole in front of the board and the switch at the back. This is a well-made and convenient type of switch. There are various forms of the tungsten lamps as made by the General Electric Company for this work. Fig. 6 shows one of the forms of these tungsten lamps; this type is made in 2, 4, and 6 candle-power sizes. Fig. 7 is another variation and is popular for automobile headlights. Fig. 8 is a good shape of lamp for use in 2, and 4 candle-power sizes for interior work in limousines. Fig. 9 shows a lamp in a socket attached to an accomodation fixture which may be used in converting oil lamps over to electric fixtures.

The General Electric Company has gone into this matter at some length and Fig. 10 presents a form of equipment that may be used in converting gas head lamps over to use them in electric lighting work. This outfit includes an Edison-Swan socket, reflector, and a suitable bracket; any one may make the change-over.

Practice Is Well Defined in Several Quarters

As an illustration of the practical application of lighting dynamos to automobile motors reference may be had to Fig. 11 of the system known on the market as the "Aplco," made by the Apple Electric Company, of Dayton O. This dynamo is shown at D1, taking power directly from the half-time train of gears and it rests on a shelf S1, as shown in this case on a Speedwell motor. Each maker of lighting dynamos has its own style of regulating the speed, and it is in these particulars that the automobilist will be in a position to exercise his acumen.

One of the most important matters that will have to be disposed of in the long run, has to do with the placing of lighting dynamos on automobile motors. When dynamos of this character become regular equipment, automobile engineers will, of course, study the situation, and it will be for them to establish a standard to which all makers of lighting dynamos will, no doubt, adhere. Why this standard should not be established now is a question that is being agitated, nor is it believed that there can be too much of an effort made; certainly, it will be of the greatest advantage to the patrons of the industry to be placed in a position to add lighting equipment, if they so elect, without having to go to great pains and cost in the application of the dynamo to the motor.

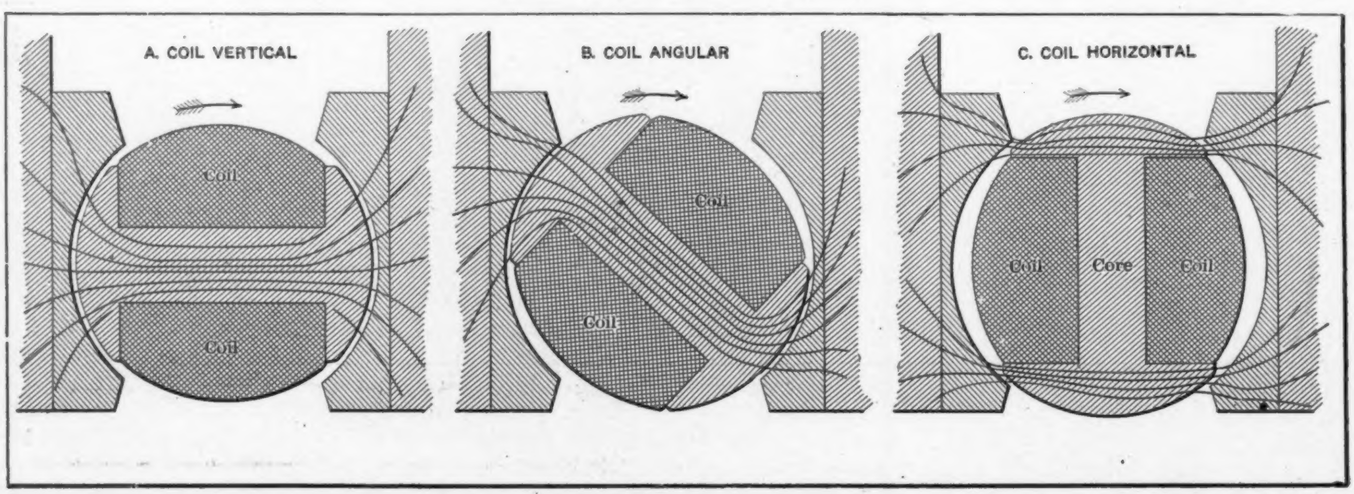


Fig. 14—Three views of a rotor, showing the large number of turns of wire that are used in practice and the changing positions of the rotor due to rotation

There is quite a problem concealed in this question of standardizing the application of the lighting dynamo. This is not the only equipment that is pressing for space. The air compressor, as used for inflating tires, is also in need of attention. The truth is that there is a great demand for concerted action on the part of designers of motors; such action, in fine, as will result in the solution of all of these problems, and it would be a great stride in the forward direction were it possible to have the whole matter taken up and threshed out. There is no longer any question about the good that resides in the dynamo for lighting purposes; the sooner it comes into general use the better; all that stands in the way is the difficulty attending the placing of the dynamo on motors that have been so designed that there is no space reserved for the lighting machine.

Magneto Thought of for Lighting Purposes

There is a lingering hope in the breasts of automobilists that magnetos, as they are used for ignition work, will do a double duty, and that they should be pressed into lighting service as well as for ignition work, is what these advocates firmly believe. But there are probably a round dozen of reasons why this plan will present much of trouble in its application.

on a par with air in the delivery of the magnetic flux. Air is regarded as an insulator so to speak, that is to say, in the building of a magneto or dynamo, an air-gap is employed to prevent magnetic leakage, although it must be remembered that there is no known material that will serve for this purpose perfectly.

Referring now to Fig. 13 of a magneto, showing three views, the object at the right is characteristic of the action that takes place in a magneto. The permanent magnets form the frame and the path of the magnetic circuit is around the loop made by the permanent magnets. The shoes S (one on each face of the permanent magnets) are bored out to accommodate the rotor or armature, and the winding on the armature is represented by a and b, with arrows showing the direction of the flow of the current through the conductors formed by the windings; these turns of wire are called "inductors"; the current is induced into the windings when the armature (over which the wire is wound) is rotated in the magnetic field, which is shown here by dotted lines. The cutting of these lines by the inductors is responsible for the current set up in the "inductors," and the density of the current set up is proportional to the density of the magnetic flux, the number of the inductors, and the speed of cutting in feet per second. The middle object in the figure shows the

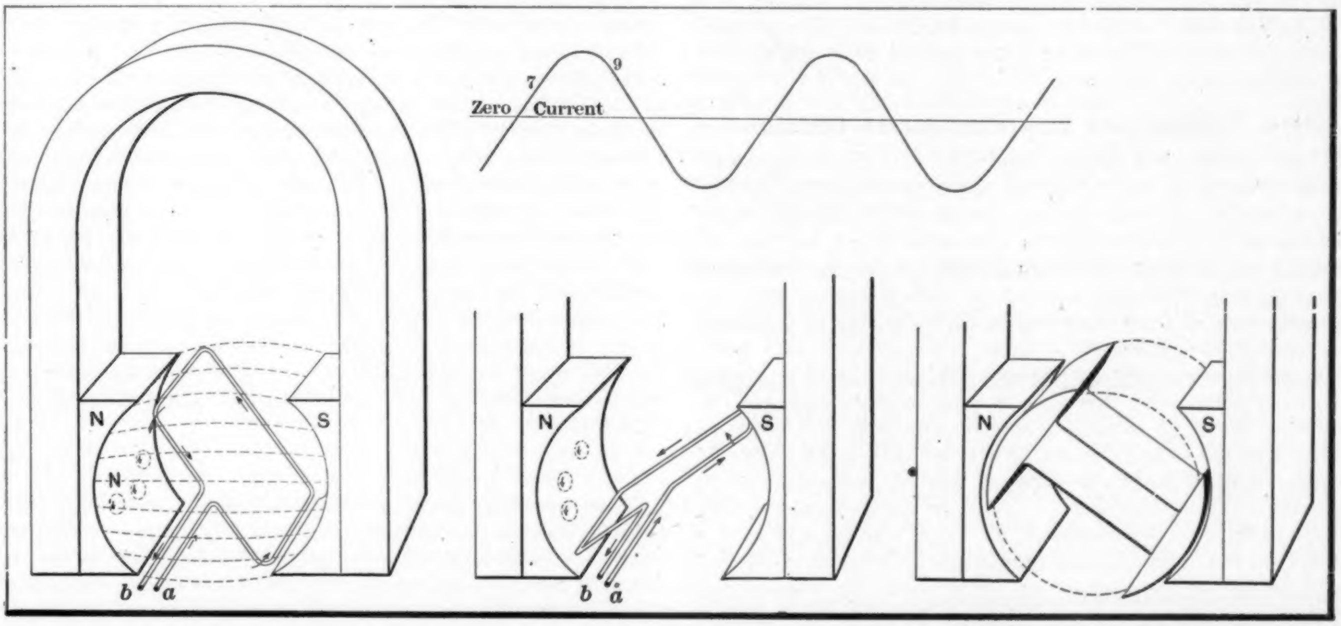


Fig. 13—Three views of a magneto, showing the relations of the parts and the path of the magnetic flux as it is cut by the inductors

In order to work up this idea to a conclusion that will be clear to the reader who has very little time to put in upon the study of such matters, some illustrations will be used, they being for the purpose of bringing to mind the formation of magnetos and helping to show how they function. Fig. 12 gives three views of a simple form of magnet, showing a soft iron core at the left; soft, in order to have high magnetic permeability; in other words, desirable magnetic qualities. The middle view is a characteristic of a magnet, showing how the lines of magnetic flux traverse the iron and circle around closing upon each other. These lines of magnetism are set up or induced in the soft iron core by an electric current that is impressed upon a winding of wire which is around the soft iron core in the manner as shown at the right of the figure, and the current is procured from a battery of 4 dry cells in this illustration, although it matters not at all as to the source of the electric supply so long as it is of the desired voltage and properly interpreted. The good result will follow in proportion as the core of the magnet, that is to say, the iron, is soft and of high permeability. Iron seems to be the only material that is good for magnets. Other materials, if they show magnetic qualities at all, deliver but a feeble magnetic flux. Most materials rank

inductor loop beginning at a and ending at b. This loop is suitably connected to a collector ring in practice, and instead of one turn there are a large number of these turns of wire. But the magnetic flux would not flow across such a large gap as that shown; for this reason the iron core shown at the right, of H shape, is frequently used in magneto work, it being the idea to afford a path for the flow of the magnetic flux of such low reluctance that the flux will be of great density and the "inductors" wound upon this core will be in a position to cut a large number of lines. These lines are imaginary, in a sense, but the fact remains that it is possible to calculate the results that may be obtained by considering the magnetic flux as units, made up of lines of force, and from a good permanent magnet, it is possible to realize something like 15,000 lines of force per square centimeter of area of the polar face under service conditions.

From the diagram, as shown in Fig. 13, to the sections of a magneto rotor, as shown in Fig. 14, will have to be traversed by the reader in order for him to appreciate something of the large number of turns of wire that must be placed upon a rotor in order to be able to generate a sufficient voltage to do ignition work. This view also shows the rotor in three positions,

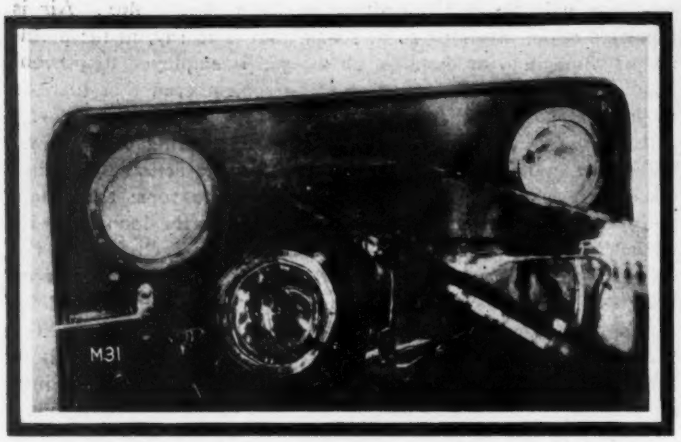


Fig. 15—Dashboard lamps of the Johnson car

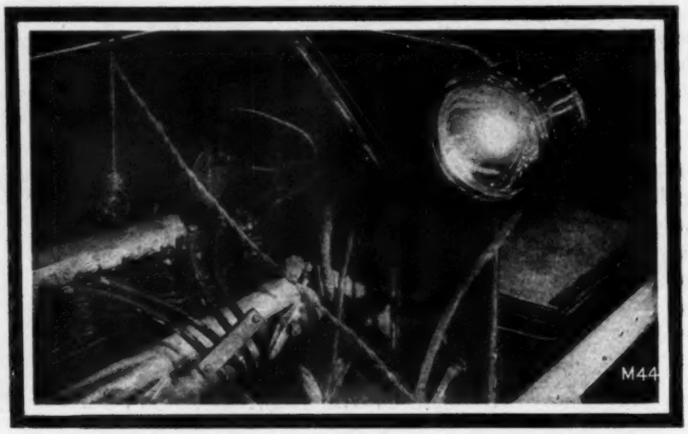


Fig. 17—Electric lamps on the Beyster-Detroit package wagon

and since it is due to the cutting of the magnetic lines of force that a voltage is induced in the windings of the rotor, it follows that the voltage induced in the "inductors" will not be constant, because the number of lines that will traverse the path through the rotor will change, due to the fact that the iron of the rotor does not afford a constant path, and during a part of the revolution the "inductors" are isolated from the path of the lines, as shown at the right.

High Voltage and Low Current Is Obtained

It will be apparent to the man who has given the matter any attention at all that a magneto is so designed that the output is contrary to that which is employed in lighting work. The voltage in magneto work is very high indeed, but the current is correspondingly low. In lighting work, the voltage is very low indeed, and the current is correspondingly low. In magneto work, of the present high-tension sort, the voltage from the fine winding of the rotor is not far from 3,000 as a minimum, and it may exceed 10,000 volts.

But even assuming that all of these matters will bow to treatment, there still remains a crop of difficulties that will have to be set to one side ere it can be claimed that magnetos would do good ignition work and serve as lighting equipment at the same time. It was pointed out that the voltage changes with the magnetic flux that traverses the rotor core as this flux is cut (rate of cutting) by the "inductors." Now, the magnetic flux is induced in the magnetic circuit by electro-magnetic means, in other words, a magnetomotive force is set up in the iron, and in a magneto this force is so fixed in the metal by hardening it that it remains there. But as a current is induced in the windings of the armature the magnetic reluctance of the path is increased with this current, and this source of a variable character is enough to put the system awry if it is to be used for lighting and ignition work, due to the fact that the lag of the spark, due to changing conditions in the magnetic circuit, would defeat the proper timing of the spark. The exacting nature of the sparking service demanded at the present time is such that there is small chance of being able to load the sparking equipment down with a double duty. The wave of electromotive force of a magneto is shown in Fig. 13, at the top and right, and as will be seen, this wave is of the alternating current characteristic. The effective voltage of this wave is very complex to determine under the most clearly defined conditions, and the effect of a disturbance in the circuit, as that due to the imposition of an extra duty, would make it quite impossible to arrive at even an approximate conclusion. But, in any event, there still remains the fact that the windings upon the rotor of a magneto are fine and the electrical resistance is very high. This would lead to another difficulty; the voltage would drop instantly were a large load imposed, such as enough electrical current to do lighting work. It might be said that the sizes of wire can be increased, but this is not so apparently, and if there is any chance of so doing, it remains for some smart electrical engineer to accomplish the feat.

Rust-Proofing Iron or Steel—A new method of rust-proofing iron or steel consists in treating the surface to be protected first with ferric chloride, an oxide being produced by reaction of the salt with the metallic surface. This is followed by the application of an aniline salt soluble in water, preferably aniline sulphate, which becomes intimately mixed with the oxide layer. The surface is then treated with chromic acid. The aniline black thus produced forms a strongly adhering color with the oxide. The ingredients may, however, be mixed together with linseed oil and the iron painted therewith.—*Motor Trader.*

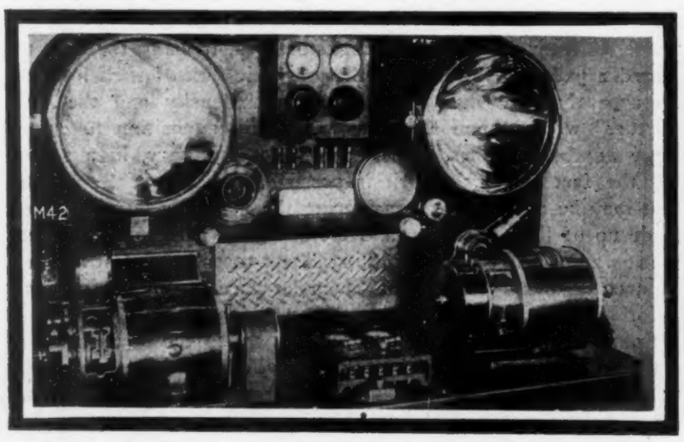


Fig. 16—"The Magic" Dynamo and some applications to lighting, heating and operating horn and cigar lighter

Fig. 18—Electric cigar lighter, with self-winding spring reel, also electric trouble lamp

The Automobile Pays Its Way

SOME PERTINENT COMMENTS ON THE USEFULNESS OF THE SELF-PROPELLED VEHICLE AS AN ALL-ROUND "QUICKENER"

FIVE hundred terse sentences bluffly captioned as "The Motor Craze" in a recent number of *The Outlook* give the views of Edward S. Martin, sociologist, as to whether Americans are spending more money for automobiles than they ought to. As this question is far from being a burning or even a smouldering one, since no one really believes that any possible purchaser of an automobile can be induced to place himself under guardianship with regard to his personal expenditures, Mr. Martin persists deftly in turning it to one side and presents instead a bright-colored picture of "the automobile in American civilization," dressed up as a running comparison between money's worth and automobiles. Has money ever done as much for America as automobiles are doing? And, if not, why whimper at seeing some of it converted intô the more useful form? Only those purveyors of bonds, diamonds, grand opera, ostrich plumes, oriental rugs and other pale-blooded luxuries, who would have liked to see that self-same money pass by way of their bills receivable have reason for grunting, and their patriotic emotions are balanced nicely, in the economics of national happiness, by the satisfaction afforded builders of machine tools, builders of good roads and of cozy country and suburban homes. And the large army of mechanics and commercial workers who draw their pay directly from the automobile and its equipment, are nearer to our life purposes than sharp investment brokers or importers of inert foreign products. The automobile, as the foremost machine tool in ordinary human life, naturally clashes a little at first with rule-of-thumb living of the old sort.

The distinction between money and wealth, or expenditures and waste, is not always kept sharp in *The Outlook's* facile and tripping commentary on the situation, but the logic of the author does not suffer vitally from the lapses. If a million automobiles were made every year in America, the amount of money in circulation and seeking employment might remain the same, though forced to circulate a little faster. The question is only if automobiles can be made without reducing the production of other useful commodities which are distinctly needed. Do they reduce or increase the production of wealth? Is the capital available for productive investment at the end of the year, and after consumption has been taken care of, greater or smaller, by reason of the automobile?

If the automobile saves as much time for its user, or users, in the course of its alleged average lifetime of four years, as it takes to produce it—counting in work-hours per man—all the pleasure it affords and much of its indirect utility would seem to be "to the good." The time of an automobile owner is usually productive. The pay for his energies comes out of production somewhere. It is in fact immaterial, economically, whether the automobile saves him working time or adds to his working energies.

There should be as many good and useful commodities for consumption by the public and as much capital for investment in new or increased production of these commodities, after the money has been spent for automobiles as before. Money is indeed never spent, but always ready and anxious to tackle a fresh task.

The Outlook takes still broader ground. Mr. Martin says: "What we want in this world is life. What gives the most life for the money is the best bargain." And again: "Usually every new luxury that we add to our apparatus of life increases the burdens that bend our backs, but this new luxury that goes by gasoline seems disposed to make a place for itself by crowding some of the other luxuries off. That shows spirit." To our mind it shows self-supporting utility. Marble statues never crowded any other current commodity off the market.

There is particular pleasure in quoting one more passage, in which the author barely touches upon the deepest of all the benefits civilization owes to the automobile. "Automobiles get a good deal nearer to the masses of the American people than steam engines ever did. Most of the growing boys seem to know more or less about them and how they go—a great deal more, indeed, than average American boys have ever taken the trouble to know about a horse." Yes, automobiles move, while the steam engines are mostly pumping away in one place. And there is such a great deal to be known about automobiles, as against so much to be guessed at about the horse. If every one of the one million automobiles used in America teaches five American boys something about mechanics and engineering, something about alertness and reasoned self-reliance and something about knowing rather than guessing—all of which the schools had failed to teach them, or they would not be so eager for the learning of it—the nation may safely count all the work-hours spent in the automobile industry as the most productive investment that has ever been forced upon it through the inexorable logic of events.

Tight Fit on the Shaft

Whenever It Is Possible a Power Press Is Preferable to a Hammer

CONSIDERABLE difficulty is sometimes encountered in dismantling a car or in assembling parts that have been remade where the fit has to be tight. In this instance the bevel pinion has to be removed from the shaft to which it is attached with a pair of keys on a tapered end. Heat can be applied in cases where the metal has not been hardened, but in the particular job on hand heating the pinion would be liable to destroy its case-hardening. A blow with an ordinary hammer will damage the end of the shaft and may be inadequate to perform what was intended. By means of the power press just sufficient pressure can be exerted, and so gradually that no damage will ensue. The shaft is bolted in a collar in which a hole has been drilled slightly larger than the shaft itself, forming a clean, flat surface for the pinion to rest upon.

Method of using power press in removing bevel pinion from live axle shaft

Edison Storage Battery

SOME FACTS CONCERNING THE MAKE-UP AND CAPACITY OF THIS BATTERY, WITH A SERIES OF CHARTS DEMONSTRATING ITS EFFECTIVENESS

SEVERAL very interesting points were brought out in a recent interview granted THE AUTOMOBILE by Thomas Edison. Among them the inventor offered a broad justification for the future of the electric vehicle, saying that the automobilist, while perfectly satisfied with himself and the position he occupies, may not be averse to having his intellect tickled by the inference that there must be something in it since gasoline costs $32 per ton and steaming coal, such as is used by central-station companies, is at a premium price when the cost is one-eighth of the price of gasoline.

The central-station man has in his possession two fundamental reasons why he can afford to make concessions to the automobilist who wants a charge for his battery. The first reason is that he has his machinery lying in idleness (90 per cent. of it) 22 hours out of every 24. The second ground for his interest presents itself when the fact is taken into account that what the central-station man really sells is the energy that he abstracts from coal, putting it in the form of electricity, the cost of which to him is represented by the cost of the coal per ton, plus the money he puts into it in making the conversion from the energy as it resides in coal to the electric energy that he pours into the battery when the automobilist comes for his charge.

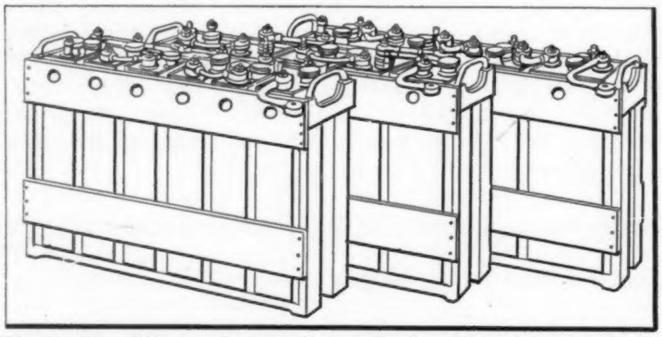


Fig. 1—The Edison vehicle battery, showing how six cells of battery are joined and assembled in crates

When Mr. Edison states that the future of the electric vehicle is clearly incumbent upon the battery he reiterates a situation that history proves, not forgetting, however, that there are so many good things to be said in favor of electric vehicles that despite storage battery imperfections they have survived and are looked upon by the average autoist as entirely satisfactory under certain conditions, approximately competitive under other conditions, leaving it for the storage battery in its final perfected form to extend their radius of travel and place at the disposal of those who desire to tour, using electric vehicles that will take them where they want to go, means of obtaining a charge at the end of each day's run wherever they happen to be.

A significant statement made by Mr. Edison may be restated as follows: "When the storage battery reaches a state of perfection where it will furnish all the energy required to propel a car for a whole day there remains nothing to be desired."

The Edison vehicle battery, as shown in Fig. 1, is composed of a plurality of cells, made up of positive and negative elements in a steel can, the latter being sealed, and, as the illustration shows, six of these cells of battery are joined together and assembled in a wooden crate. Three crates of cells are shown, but there may be any number, depending upon the potential difference required in charging and the design of the charging equipment. These cells of battery are known at the Edison plant as type "A" or "B," and are marked A-4, if there are four positive elements, A-6 if there are six positive elements and A-8 if there are eight positive elements, or B-2 if there are two positive elements and B-4 if there are four positive elements. The B-4 size is rated at 90 ampere hours, and besides offering a wide opportunity in ignition work is available for the electric lighting of gasoline automobiles. The B-2 size is rather too small (45 ampere hours) for electric lighting and is confined to ignition work. The "A" series are designed specifically for electric vehicle service and street car work.

Innumerable repetitions of tests have shown that the cells as commercially manufactured have surprisingly uniform capacity and that under any similar conditions, no matter how abnormal, different cells will give practically identical results. The same characteristic of constancy of behavior applies also to the different sizes of cell, and at comparative rates they have similar characteristics, except for inconsequential variations in heating due to differences of radiating surface. This is shown in the curves of Fig. 2.

The relations of current and energy output and of current and energy efficiency to the length of charge at normal rate are summarized in the curves of Fig. 3. These curves show maximum efficiencies on short charge of practically 99 per cent. in ampere-hours and 75 per cent. in watt-hours, while on normal 7-hour charge the efficiencies are respectively 82 per cent. and 58 per cent.

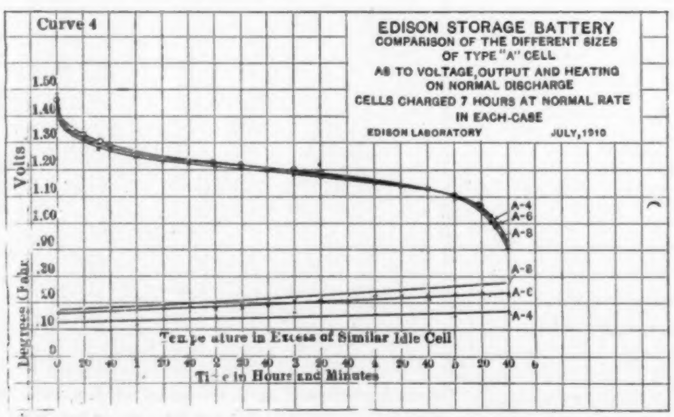


Fig. 2—Showing effect of temperature upon the capacity of the different sizes of battery

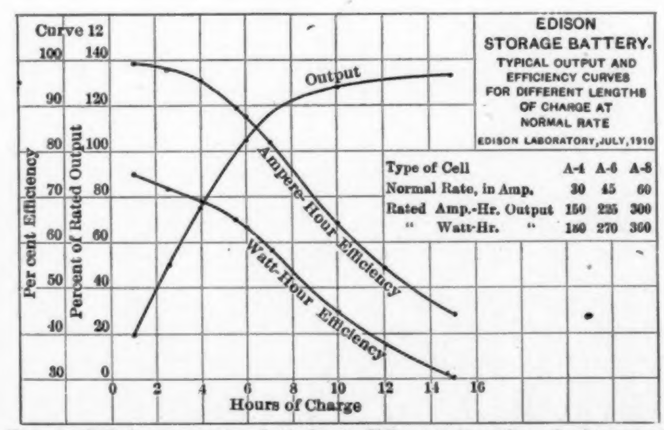


Fig. 3—Efficiency tests plotted at different lengths of charge at normal rate

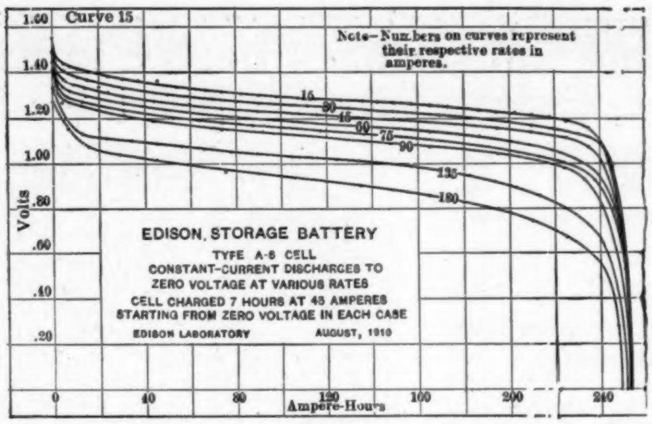


Fig. 4—Constant current discharge to zero voltage at various rates of discharge

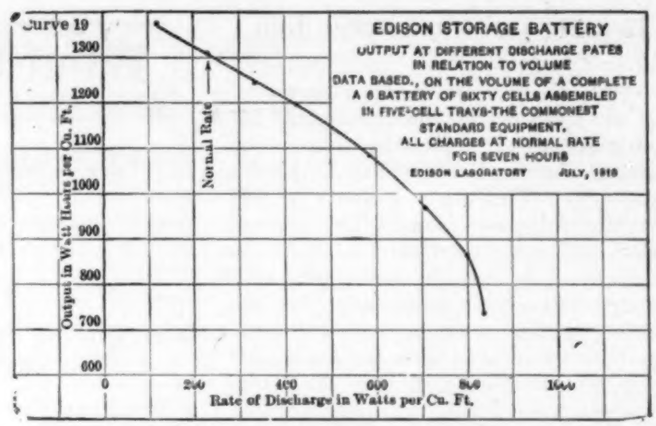


Fig. 6—Output in watt-hours at different discharge rates in relation to volume

Watt-hour efficiency is the product of ampere-hour efficiency and "volt efficiency"—the latter term being used synonymously with the term "coefficient of drop" to express the relation of the average voltage of discharge to the average voltage of charge. The volt efficiency depends principally on the rates of charge and discharge and does not vary much under ordinary conditions. Charging and discharging at normal rate, its value will be close to 72 per cent. for any length of charge not extremely short or long; and this figure therefore represents the practical limit of watt-hour efficiency for normal-rate working. The watt-hour efficiency on any normal-rate test may be calculated accurately enough for all practical purposes by taking 72 per cent. of the easily determined ampere-hour efficiency. Decreasing the current rate increases the volt efficiency, thus raising the limit of possible watt-hour efficiency.

The Edison cell has an air-tight cover, a valve being provided for the escape of gas. Practically no water is lost by evaporation, therefore, and the battery can be left idle for months without attention and there will be no danger of the solution getting low. Water is lost when a battery is working, however, and this results entirely from overcharging for any current which is not used to effect the chemical changes at the electrodes goes to produce hydrogen and oxygen, the elements of water, which are emitted as gases. To replace this loss, pure water must from time to time be added. The figure of ampere-hour efficiency represents the proportion of a charge which goes to produce the desired chemical changes at the electrodes; therefore the balance is proportional to the loss of water. Thus from the curve, Fig. 3, we see that charging 7 hours at normal rate (210 ampere-hours input) the ampere-hour efficiency is 82 per cent. and charging 10 hours (300 ampere-hours input) it is 64 per cent. The loss of water therefore would be represented by 18 per cent. of 210 = 38 ampere-hours in the first case and by 36 per cent. of 300 = 108 ampere-hours in the second case, showing that a battery which is worked continually on 10-hour charges would require the addition of water about three times as often as one worked continually on 7-hour charges. This points to the possibility of reducing the amount of required filling to almost nothing in those cases where a battery can be worked on short frequent charges at high efficiency.

Constant current discharges of the Edison battery at no matter what rate are found to give a quite constant output figure if carried to very low voltage (see Fig. 4), and differ only as to average voltage, this being higher or lower, according as the I R drop in the cell (depending on the I-valve) is little or much. The low voltage part of the curve cannot be considered useful, however, as the statement sometimes made that the ampere-hour output of the Edison battery is independent of the discharge rate is not strictly true. On the other hand, it would not be a fair test to terminate high-rate discharges at 1.0 volt or 0.9 volt, as is done usually in normal-rate tests, because this would not correspond to the same state of discharge, and the cell would start the next charge in a semi-charged condition, which would make the subsequent discharge abnormal.

In Fig. 5 is given the energy output at different rates of power delivery calculated for one pound of Edison battery, and the same referred to one cubic foot of battery is given in Fig. 6. The figures are based on the total weight and maximum volume of a complete battery of a standard number of cells.

An interesting but not at all surprising characteristic of the Edison battery, which probably is common to storage batteries in general, is the fact that the rate of loss of charge during idleness varies with the temperature at which it stands, the loss being slight in the cold and greater as the temperature increases. Fig. 7 shows the results of two series of tests in one of which the cells after charge were immediately put in an ice box to stand while in the other case the cells were left to stand in a room whose temperature averaged close to 75 degrees F.

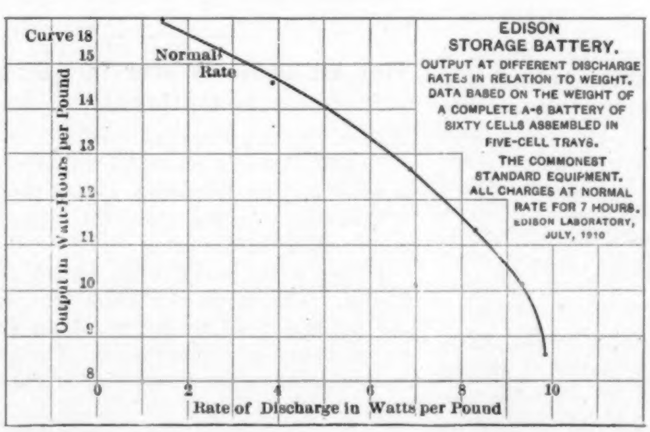


Fig. 5—Output of different discharge rates in relation to weight of battery

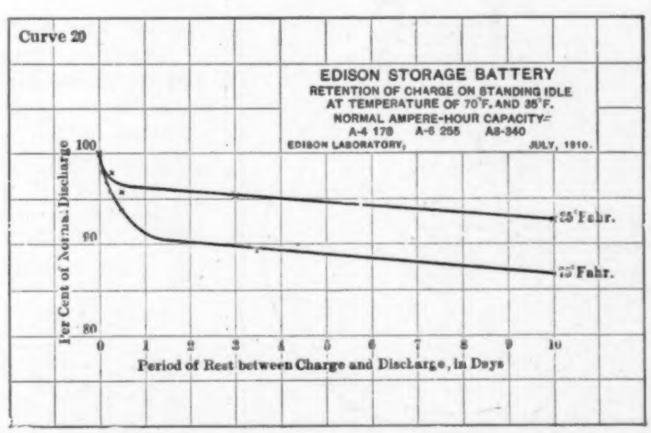


Fig. 7—Relation of charge on standing idle at different temperatures

What Some Subscribers Desire to Know

Heating the Intake Manifold

Editor THE AUTOMOBILE:

[2,484]—I was very much interested in the cut about heating the intake pipe and carbureter, and as I have the same trouble in cold weather I would like to have a little more information. I would be very thankful for your advice. The enclosed sketch will give you some idea as to the location of the engine, water pipe, carbureter, and intake manifold on my car. The carbureter is in a very cold place, nearly two feet away from the engine, and it is not possible to shorten the intake manifold. The upper water pipe is brass. Can a copper pipe be connected to this, wound around the intake, and then connected back to the brass water pipe again? Also please tell me how to fasten the copper pipe to the brass water pipe, and how to drain the copper pipe; also what to use to make these connections. Will there be any advantage in heating the gasoline by laying the feed pipe from the tank close along the brass hot water pipe which gets very hot from the water, or will there be any danger of overheating the gasoline so as to cause an explosion.

FRED ZEITZ.

Farnhanville, Ia.

We have redrawn the sketch you sent as shown in Fig. 1, which shows the method of inserting a coil around the intake manifold, and the dotted line from the gasoline tank to the carbureter represents your suggestion as to heating the gasoline prior to its entrance into the carbureter. The gasoline should not be heated in this manner as from tests that have been carried out, disturbances are set up which prevent proper carburetion. Fig. 2 shows the method of attaching the pipe to encircle the intake manifold. The ordinary brass union can be sweated into the pipe but it is better to tap a small brass block in the manner shown in the illustration, and make the union more secure, and easily removable.

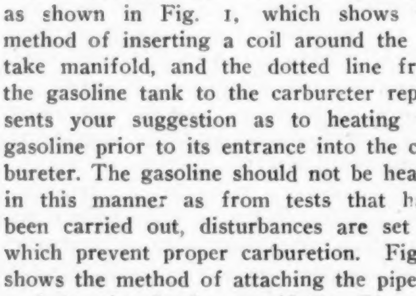


Fig. 3—Method of calculating amount of advance from fly-wheel marks

Determining Spark Advance From Flywheel Marking.

Editor THE AUTOMOBILE:

[2,485]—Will you kindly give me an answer to the following problem, and how you figure same.

Engine has 4-inch stroke; flywheel is 18 inches in diameter; spark advance is 1 7-8 inches on circumference of flywheel. How much is the advance on the stroke?

ADOLF A. GEISEL.

Springfield, Mass.

The formula for finding the circumference of the flywheel as shown in Fig. 3

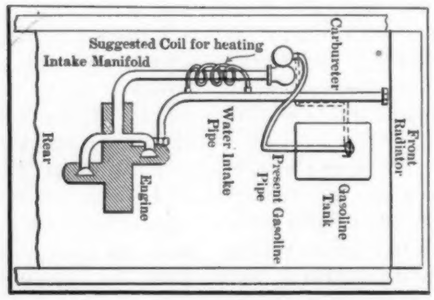


Fig. 1—Method of heating intake manifold

is: $2 \pi R$, which according to the above data gives you a circumference of 56.548 inches. A quarter of this, which equals 14.137 will give you the amount of travel of the flywheel for one stroke of the piston. If this latter figure is divided by the amount of advance it will give you the proportion of four inches represented by the full advance of the ignition.

Air Pump Drive.

Editor THE AUTOMOBILE:

[2,486]—I am desirous of fitting a pump on my car for tire inflation. Is it possible to operate this from the gearbox instead of the motor? The car I have has the motor and transmission in a single casting, and it would be difficult, if not impossible, to extend the gearbox shaft in the manner used on one of the cars shown at Madison Square Garden recently.

H. F. C.

Portland, Me.

The accompanying sketch as shown in Fig. 4 will show you the method of driving an air pump employed on a foreign car. The cylinder is cast with ribs as used on motorcycles, and a gearwheel G1 meshes with a fixed gearwheel inside of the gearbox in the manner as shown. The valve V is an ordinary suction type of valve, and the shaft F is set eccentric.

The Editor invites owners and drivers of automobiles who are subscribers to THE AUTOMOBILE to communicate their automobile troubles, stating them briefly, on one side of the paper only, giving as clear a diagnosis as possible in each case, and a sketch, even though it may be rough, for the purpose of aiding the Editor to understand the nature of the difficulty. Each letter will be answered in these columns in the order of its receipt. The name and address of the subscriber must be given, as evidence of good faith, adding a nom de plume if the writer desires to withhold his name from publication.

Having Trouble with a Planatery Gear

Editor THE AUTOMOBILE:

[2,487]—I have been running a planetary type automobile engine and have been having more than a little trouble with the grease working out of the differential to the brake bands, causing the car to slip when the brakes are applied, and splashing the grease all over the wheels and tires. Kindly give me your advice as to the remedy for this trouble.

Kingston, N. Y. A NEW SUBSCRIBER.

It is just possible that the joint around the cover of the planetary gear can be made tight by drilling and tapping for a series of No. 12-28 screws, they to fall between the points of the holding bolts, and thereafter make a mixture of yellow oxide of lead and glycerine to use as a cement in conjunction with a piece of ordinary twine which should be interlaced around the joint in such a way as to be held in place by the holding joints aided by the No. 12-28 screws. After making the joint tight in this way, care should be exercised to use a limited quantity of some excellent grade of grease as recommended by some responsible maker of automobile lubricants.

Hot Air or Hot Water for Heating Is Optional

Editor THE AUTOMOBILE:

[2,488]—I am a subscriber to your publication and an interested reader thereof. I therefore take the liberty of asking for some expert information.

I have a car which I am having overhauled. The carbureter which was on it did not give good results, and I am going to put on one of another make. The inside measurement of the intake pipe at the car-

What Other Subscribers Have to Say

The Editor invites owners and drivers of automobiles who are subscribers to THE AUTOMOBILE to communicate their personal experiences for publication in these columns for the worthy purpose of aiding brother automobilists who may be in need of just the information that this process will afford. Communications should be brief, on one side of the paper only, and clearly put, including a rough sketch when it is possible to do so, and the name and address of the writer should be given as evidence of good faith, adding a nom de plume if the writer desires to withhold his name from publication.

bureter joint is 1 1-4-inch hole, as are the ports. The cylinders are 3 1-4-inch bore by 3 3-8-inch stroke. The mechanic who is doing the work is of the opinion that a carbureter of 1 inch opening would be sufficient, while I cannot agree with him. The installing of a new carbureter in this case means a new intake pipe manifold. Would you advise a water jacketed carbureter or hot air jacket? H. J. BERRIEN.

New York City.

Good results are being obtained with both of these methods of heating the carbureter, and hot air offers the advantage of heating the mixture after the motor has turned over a few times, whereas with hot water it takes a few minutes to heat the water up before it will be available for the purpose. On the other hand, hot water offers a more stable form of heating and a fixed temperature that is attractive in carbureters designed for the purpose.

No reason why the carbureter should not be as large as the manifold will accommodate.

Cold Compression Should Be the Highest

Editor THE AUTOMOBILE:

[2,489]—Please answer the following question in your "Letters" column:

When is the best time to get the highest compression test, when the engine is cold or after the engine has been run for some time and is hot?

Savannah, Mo. W. I. BROWN.

All that would prevent the cold compression from being the highest would be lack of lubrication. If the lubricating situation is in good shape, the cold compression will be maximum; first, because there is more weight of gas when it is cold; second, because the lubricating oil would form a better seal around the piston rings, and finally, the time allowed for the gas to enter through the intake valve would be maximum.

Ordinary Half-and-Half Solder Will Do

Editor THE AUTOMOBILE:

[2,490]—Kindly answer the following question in your "Letters" column. In my engine there is a plug to drain the gasoline reservoir, but it cannot be screwed in tight enough to stop it from leaking. Is there anything that gasoline will not dissolve that I could put on the threads to make it hold?

Greensburg, Pa. W. W. MONROE.

Piston Travel Is the Missing Link

Editor THE AUTOMOBILE:

[2,491]—I have frequently noticed the different A. L. A. M. ratings of automobiles in your magazine. Now, why is it that there can be two different motors of different sizes and still have the same rating? For example: Take a 4 x 4 motor, it

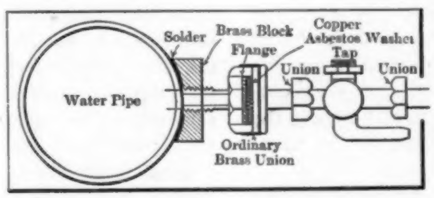


Fig. 2—Method of attaching heating pipe to water pipe

is rated 25.6 horsepower; also a 4 x 4 1-2 motor is rated at 25.6 horsepower. Please explain.

Portland, Mich. C. O. D.

In figuring out the A. L. A. M. rating of a motor the piston travel is taken to be 1,000 feet per minute, so that the length of the stroke is neglected in the formula. It is for this reason that a 4 x 4 motor would have the same rating as a 4 x 4 1-2 motor. The assumption is that the 4 x 4 1-2 motor would rotate at a slower speed than the 4 x 4 motor, and that both motors would have a piston travel of 1,000 feet per minute.

It Is Not Safe to Monkey with Explosives

Editor THE AUTOMOBILE:

[2,492]—During the severe cold weather I have had quite a little trouble with the gas generator which supplies my headlights and while I have put quite a large percentage of alcohol with the water it still freezes. It seems that after the water is shut off there will be a drop or two of water in the drip tube, and I suppose the alcohol evaporates from the water and it then freezes. How would it be to use gasoline in place of water and alcohol and let this drop on to the carbide? A reply through THE AUTOMOBILE journal will be appreciated. C. B. DOTEN.

Portland, Me.

Calcium carbide, unless it is quite pure, and even so, handled under the conditions as ordinarily prescribed, has inherent possibilities that might lead to serious inconveniences. There seems to be no objection to adding anti-freezing materials with water to prevent it from freezing, but the indiscriminate use of all sorts of chemicals is not to be recommended. Acetylene gas is the product of calcium carbide and water. Gasoline is not water.

Automobilist Relates an Interesting Experience

Editor THE AUTOMOBILE:

[2,493]—I am having a mystifying experience for which I would like an explanation. Every morning, after being sure that a cylinder is ready for the spark, I prime each of my four cylinders through the priming cups and invariably start from the spark, the engine being absolutely cold. After operating a while the same procedure will not ordinarily permit a start from the spark, an actual count of twelve times giving four starts and eight failures, although a cylinder was ready for the spark. It appears that starting from the spark with liquid gasoline thrown into the cylinders is much easier with a cold than a hot engine.

When the engine is cold, after having stood for some time, the gases have escaped, so that when gasoline is injected it forms a combustible mixture. When the engine has been run and is still hot, the cylinders retain a large percentage of the previous charge; consequently when gasoline is injected the mixture becomes surcharged with gasoline, giving a larger proportion than is necessary.

Terre Haute, Ind. A. A. WOLFE.

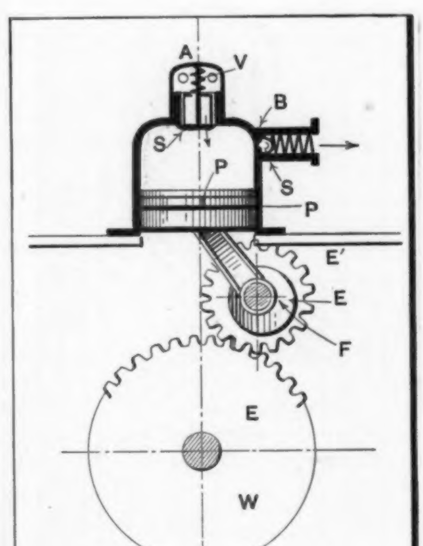


Fig. 4—Showing system of driving air-pump on Hispano-Suiza

New "Ironclad-Exide" Battery

BRUCE FORD DISCUSSED THE LATEST DEVELOPMENT IN EXIDE BATTERY WORK IN A PAPER PRESENTED BEFORE THE ELECTRIC VEHICLE ASSOCIATION OF AMERICA ON JANUARY 17, 1911

THE new battery is of the lead sulphuric acid type, and its principal feature of novelty resides in the construction of the positive plate, together with other features of mounting and connecting, which will be brought out later.

The flat plate form was many years ago recognized as the best electrode for both positive and negative plates. Two forms of design have been in vogue for many years. First, the plain plate or slab, and, second, a plate composed of a number of parallel bars or rods laid side by side and mounted in a suitable frame. Where the latter design has been employed, it has usually been for the positive electrode or pole plate.

The new "Ironclad" positive plate is composed of a number of parallel vertical metal rods, united at their tops and bottoms integrally to top and bottom frames, the top being supplied with the usual conducting lug. Each vertical rod forms a core surrounded by a cylindrical pencil of peroxide of lead active material, which in its turn is enclosed by a hard rubber tube supplied with a multiplicity of fine horizontal laminations to provide access for the electrolyte to the active material, and passages for the flow of current during the charge and discharge of the plate. The rubber tube fits very snugly upon the active material, and its elasticity allows a certain come and go, maintaining its relation with respect to the active material during the alternate expansion and contraction of the latter in the process of charge and discharge.

The cylindrical form is peculiarly adapted to perform this function, and the amount of electrolyte surrounding each tube is just about the correct proportion for the active pencil. Each rubber tube is furnished with two oppositely disposed vertical ribs, which serve to stiffen and strengthen the laminated tube and act as separators, taking the place of the ribs commonly provided upon the separators of cells using plain flat plates.

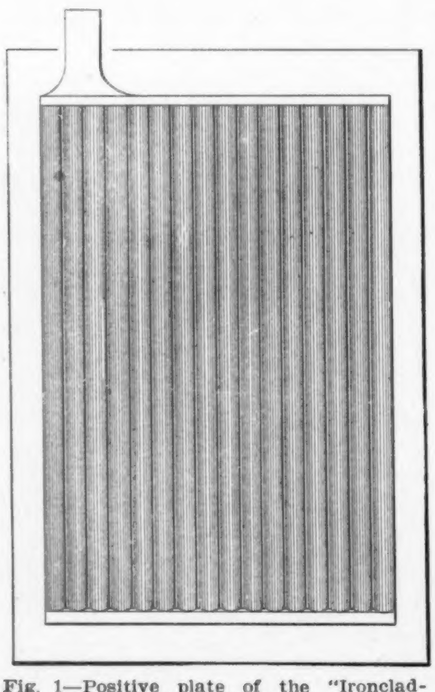


Fig. 1—Positive plate of the "Ironclad-Exide" Battery

The grid of the negative plate is of the standard "Exide" design, facial horizontal bars on one face of the plate being in staggered relation to the bars on the opposite face, the whole being united by vertical ribs at intervals.

The wood separator, consisting of a plain sheet of veneer of appropriate thickness, is interposed between the face of the negative plate and the vertical ribs of the rubber tubes of the positive plate.

Positive and negative plates respectively are united into electrode groups, their lugs being burned to pillar straps in the ordinary way.

An improvement on the pillar strap has been incorporated for the "Ironclad-Exide" battery by slightly pointing the tops of the pillars, thereby making it somewhat easier and quicker to burn the connections.

The connector used in the "Ironclad" battery is not rigid, as it is in the "Exide" battery, but is made of thin sheets of copper lead plated to protect the copper against corrosion, and provided with an alloy terminal at each end recessed to receive the pillar of the strap, to which it is integrally burned.

A battery assembled with these connectors has a very neat and businesslike appearance.

The characteristics of the cell in discharge are similar to those of other types of lead storage batteries, the potential at the normal four-hour rate starting well above two volts and maintaining a fairly uniform value throughout the discharge until toward the end, when it drops more rapidly. At 1.75 volts, the cell is practically discharged.

Similarly, its characteristics during charge are like those of other lead batteries, the voltage remaining uniform throughout the major part of the charge and rising readily to its final value toward the completion of the charge.

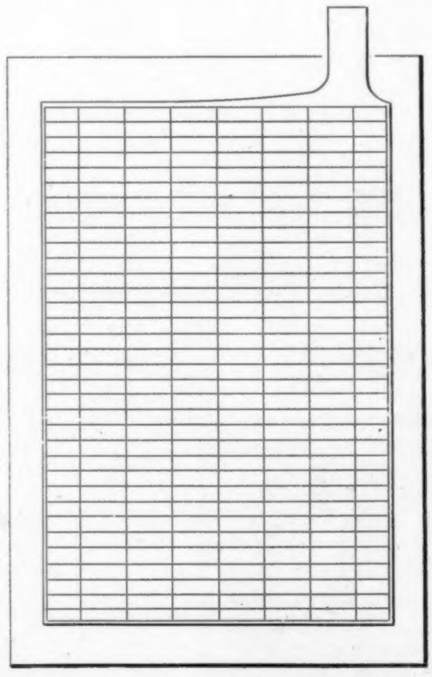


Fig. 2—Negative plate of the battery

The internal resistance of the cell being about the same as that of an "Exide" cell of corresponding size the variation in capacity with change in rate is about the same. While its capacity decreases at a less than constant rate of change with increase of discharge rate, yet its capacity becomes greater at an increasing rate as the discharge rate becomes less. This is a valuable characteristic of the lead cell when the elapsed time of discharge is extended.

The capacity of all lead cells varies slightly with changes in the temperature of the electrolyte, and the change in capacity, besides being comparatively small for comparatively wide variations in temperature, is almost uniform and so continues beyond any ranges to be met even under the most extraordinary conditions.

The new battery is rated initially at four and a half hours at a current corresponding to the four-hour rate of an "Exide" battery of the same size. For example, an MV "Ironclad" positive plate is rated at 7 amperes for four and a half hours. As the battery is worked, the capacity will increase to from five

and a half to six hours or even more. Cases have been recorded under somewhat special conditions where the capacity of the battery has reached seven hours at this rate before beginning to decrease.

The gain in capacity is not merely temporary, and although increasing at a comparatively rapid rate it decreases very slowly, so that the actual capacity is considerably above the rating for practically the entire life of the plates.

The dimensions of the elements of the new battery were proportioned to make "Ironclad-Exide" elements interchangeable with those of the "Exide" so that plates from an "Exide" battery can be renewed with a proper fitting element of the "Ironclad-Exide" type. This has been accomplished by making the new plates in both MV and PV sizes, and of appropriate thickness to be mounted upon the same plate center spacing as of the "Exide." Since the outside negatives in the "Ironclad" are of the same thickness as the negatives of the "Exide" battery, the over-all dimensions of an "Ironclad" element are therefore the same as the over-all dimensions of an "Exide" element having the same number of plates.

Since the "Ironclad-Exide" battery will give four and a half hours at the four-hour rate of an "Exide" of the same size, the capacity is 12½ per cent. more. This relation holds throughout any practical range in variation of rate, since, as already stated, the internal resistance of the two batteries is practically the same.

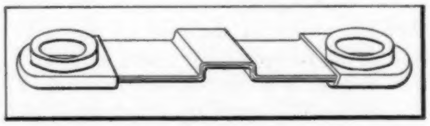


Fig. 3—New form of connector

The weight of an "Ironclad" battery is about the same as that of an "Exide" battery of corresponding size, a 9 MV "Ironclad" cell complete weighing less than one pound more than a 9 MV "Exide" cell.

This battery has these advantages:

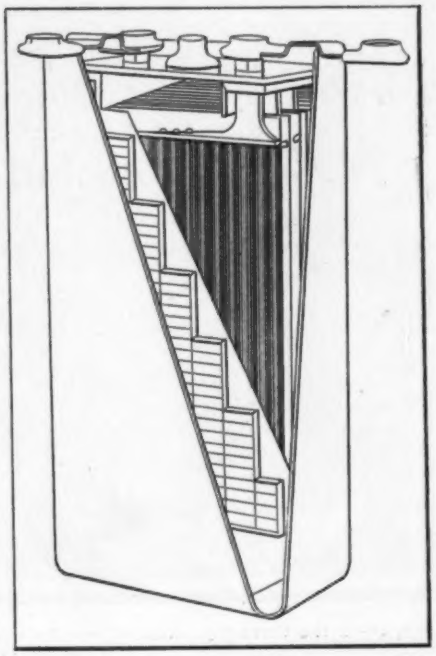


Fig. 4—Showing a complete battery with part cut away to show assembling

(a)—High individual cell voltage.

(b)—Low internal resistance.

(c)—High efficiency.

(d)—Ability to discharge at very high energy rates.

(e)—Increased capacity at decreased energy rates.

(f)—Freedom from injury by excessive discharge rates up to and including the short circuit current.

(g)—Immediate recovery from effects of overload.

(h)—Low coefficient for temperature correction and uniformity of its value, there being no critical low temperature below which the battery will be inoperative.

(i)—Accessibility in case repairs are necessary.

(j)—Small danger of explosion.

A dilute sulphuric acid electrolyte which has, among others, the following property:

(k)—Variation in specific gravity, which, when measured with a hydrometer, gives an indication of the state of charge or discharge of the cell.

How Spark Plugs Are Made

ILLUSTRATING THE PROCESSES OF MANUFACTURING SPARK PLUGS, BEGINNING WITH KAOLINS, SILICATES, FELDSPAR AND OXIDES IN THE PRODUCTION OF PORCELAIN

Fig. 1—Filtering the raw material with canvas bags.

SPARK PLUGS are used in the ignition system of internal combustion motors in the process of forming the "electric spark" in the gas body within the combustion chamber for the purpose of igniting the gas. The average automobilist looks upon an internal combustion motor as some mysterious product of wizards that is beyond the comprehension of the average man, but there are few of these automobilists who would fail to understand the ramifications of a steam power plant, and they appreciate the fact that water is put into a boiler and a fire is built on the grate bars of the same, so that the heat of the fire is transferred to the water and the ebullition of steam follows in the due course of time. The steam absorbs the energy out of the fuel and this energy is taken into the cylinder of the steam engine where it is given off expansively, resulting in the reciprocating movement of the piston and the reduction of the steam back to its original form, i.e., water. From this point on the method of transmitting the power is the same in all motors and engines in point of principle, and is foreign to the laws upon this subject.

Any form of gas that is a good carrier of energy will do just as well as steam, and in the internal combustion type of motor air impregnated with hydrocarbon fuel (gasoline) is sucked into the combustion chamber, and in view of the presence of gasoline in vapor form, mingled with the air in suitable proportions, the gas will light if a flame is applied and the heat evolved, due to the burning of the gas, will cause it to increase in pressure at constant volume, after which it is expanded, producing reciprocating motion of the piston, just as in the steam engine. An internal combustion motor, under the circumstances, may be described as a type of engine in which the fuel is placed directly in the cylinder of the motor and it is there burned with the result that the energy originally residing in the fuel is transferred with greater or lesser efficiency to the piston of the motor, producing reciprocating motion therein, and this reciprocating motions duly translated into rotary motion in view of the relation of the crankshaft of the motor to the piston through its connecting rod.

Laymen frequently overlook the fact that the amount of power that can be delivered by a motor cannot by any stretch

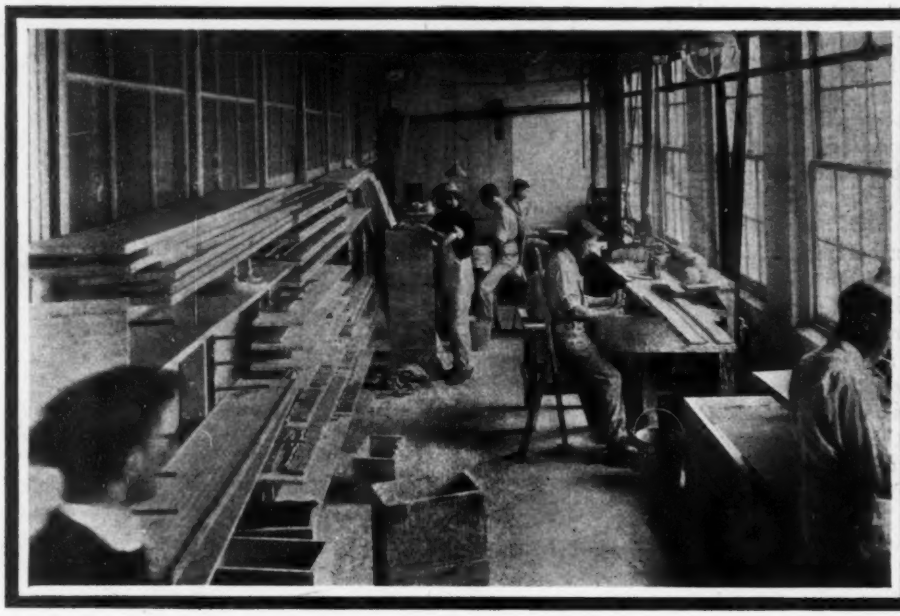


Fig. 2—In the throwing room, where the clay is made into balls and thrown into cylinders by means of disc machines

of the imagination exceed the amount of power that is represented in the energy of the fuel, and in practice it has been found that but a relatively small proportion of the energy of the fuel is utilized in the production of power. In an ordinary steam engine it is not uncommon to expect that about 8 per cent. of the fuel value is turned into mechanical work. In an ordinary gasoline motor it is reasonable to expect that about 16 per cent. of the energy residing in the fuel will be turned into mechanical work. Fortunately, or otherwise, these values are subject to change in two directions. There are a great many steam engines that do not deliver a thermal efficiency of 8 per cent., and there are quite a number of steam engines that will do 12 per cent., on a thermal basis, and there are a few steam plants that have been known to deliver a thermal efficiency of a trifle over 16 per cent. Applying the same reasoning to internal combustion motors of the type as used on automobiles it is unfortunate that the poorly designed products have a thermal efficiency that is well below 16 per cent., and some of them fall down to the 8 per cent. level. From the other point of view, it may be stated that there are types of internal combustion motors as used on automobiles that maintain a thermal efficiency of 20 per cent. and even 28 per cent. has been obtained under laboratory conditions, but the fact remains that 38 per cent. in round numbers, if it ever is arrived at, will represent the highest obtainable limit.

The very fact that the results as obtained at the present time vary over wide ranges would seem to indicate that quite a number of designers of motors have failed to appreciate the thermic relations and the needs of the occasion. If one designer finds it possible to realize 20 per cent. of the thermal value of the fuel, there is no reason why other designers should be satisfied with any less. This is not to say that 20 per cent. should be the standard, because no standard should be set below 100 per cent., but it is self-evident that the best obtainable in practice is the minimum size of the target that should be aimed at by all concerned. Confining the discussion to the four-stroke cycle type of motor, and remembering that the sequence of the cyclic units is:

(A) Suction stroke;
(B) Compression stroke;
(C) Power stroke;
(D) Scavenging stroke;
(E) Ignition takes place ostensibly at the end of the compression stroke and before the beginning of the power stroke.

Referring to the suction stroke, it is during this portion of the cycle that the mixture of gasoline and air is taken in due time to the displacement of the piston, and to the fact that the vacuum thus created is exclusively filled by air which picks up gasoline in the carbureter and is swept into the cylinder.

The second period of the cycle has to do with the compression of the mixture reducing all the gases in the cylinder to a constant volume in the combustion chamber.

While the mixture is in the constant volume state within the combustion chamber it is ignited by means of a spark that is electrically produced at the terminals of the spark plug.

Were the conditions ideal the power stroke would not begin before the burning of the mixture, thus swelling it to maximum pressure at a constant volume, and this excellent state is aimed at in any event so that the power stroke follows compression and ignition, during which period the energy that is given off by the burning mixture is more or less absorbed by the receding piston, and the more energy that is taken up by the piston the greater will be the thermal efficiency of the motor.

After the power stroke, the piston sweeps back, expelling the products of combustion from the cylinder more or less com-

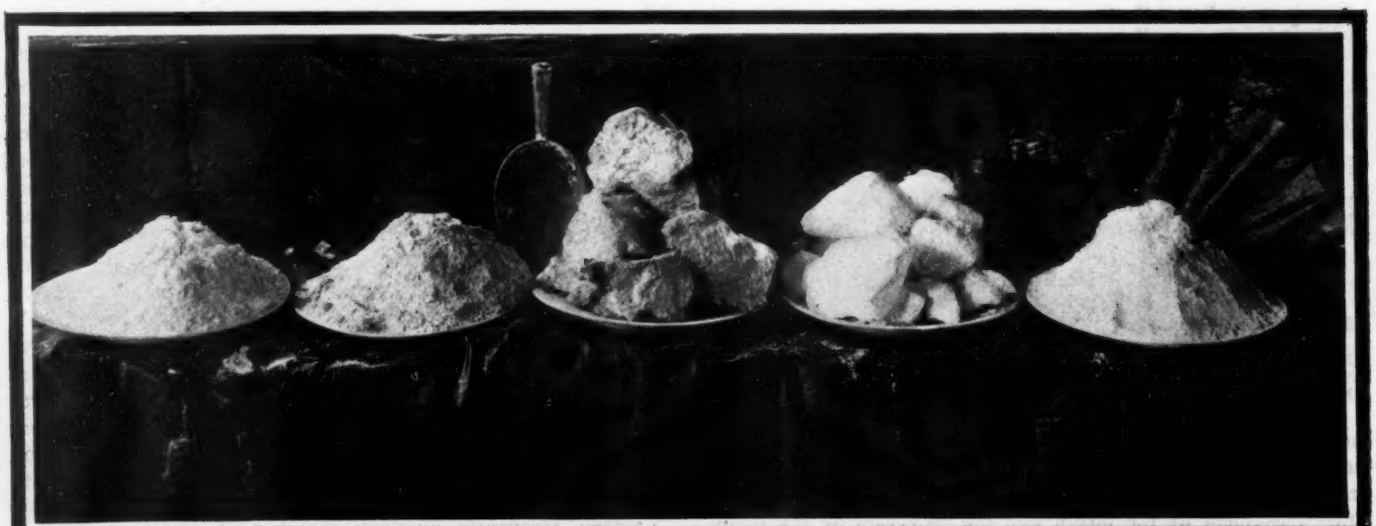


Fig. 3—Showing raw material in the form of kaolins, silicates, feldspar and oxides as used in the manufacture of porcelain ware for spark plugs

Fig. 4—Assembling room, where the porcelains and metal parts are brought together and assembled ready for packing into cartons

pletely, but since the piston does not sweep through all of the space it remains for the "terminal pressure," in other words, the remaining energy in the burnt mixture, to help in the process of scavenging, it being the case that the mixture under pressure will tend to move toward the atmosphere through the exhaust transfer ports, and were the conditions perfect, it is reasonable to expect that substantially all of the burnt mixture would exhaust from the combustion chamber down to the atmospheric pressure.

Some of the Problems Require Further Attention

If it may be considered that the suction stroke is the logical one to discuss primarily, it remains to observe that the questions involving the fuel should be analyzed and the proportioning of the air to the gasoline should receive marked attention. Since there is no fuel value in atmospheric air, all air that enters the combustion chamber must be energized, but since it takes a definite measure of oxygen to burn a definite measure of hydrocarbon, it stands to reason that if there is a lack of oxygen in the combustible mixture admitted to the cylinders, there will be a wasting condition set up, because all of the hydrocarbon that fails to combine with oxygen will pass through the cycle without burning, resulting in a dead waste. On the other hand, were arrangements made to supply pure oxygen in the energized state to the combustion chamber of the motor, a detonation would follow and the motor would be destroyed. Since the air contains a relatively small amount of oxygen and a relatively large amount of nitrogen, this detonating condition is prevented, due to the fact that no matter how much fuel is mixed with nitrogen it cannot be lighted nor will it burn. This inert element, called nitrogen, then, serves as a safety device by means of which explosions with an undue force are prevented, and the rate of burning of the fuel is regulated so that the piston, which represents the moving mass, is permitted to sweep ahead of the wave of pressure during the burning of the gas, absorbing the energy therefrom in a leisurely and relatively more efficient way. This situation would be almost ideal were it true that gasoline might be had in its best form, and were it possible to so design carbureters that they would definitely mix the gasoline with the air, giving exactly the right proportion of each component under the varying conditions of speed that have to be encountered in automobile work.

None of these definite relations are to be encountered during the suction stroke. The gasoline is a variable not only as to its fuel value, but in its other essential relations, as volatility, vapor tension, density, boiling point and specific heat. Besides the uncertainties of the fuels, there remains the lack of definite proportioning of the air, and on top of these possibilities for inefficiency there are the questions of overheating and the improper ignition of the mixture. It should be understood that the amount of fuel that can be gotten into the cylinder in a given time will depend upon the temperature therein, it being the case that the mixture will swell with the increasing temperature, and the weight of the mixture will decrease as it swells or expands.

Coming down now to the ignition problem, if it may be taken for granted that the highest obtainable result will follow if the mixture is entirely burned between the interval of compression and the beginning of the power stroke, it is the same as saying that the mixture must be lighted and burned while the piston is on the dwell point, and the ending of the compression stroke and the beginning of the power stroke. This interval of time is

Fig. 5—In the dipping room, where the blanks after being turned are dried and dipped in a thin "slip" known as glaze

very short when the motor is traveling at a slow rate of speed, and it decreases in the inverse ratio of the increase in speed. The rate of burning of the mixture is increased by compression and temperature, and decreased:

(A) By the presence of liquid gasoline entrained with the air; (B) By the presence of burnt gases due to incomplete scavenging; (C) By the feebleness of the spark as produced by the ignition system.

Since it will be necessary in any event to handle the several classes of possible troubles separately, it will be just as well for the present to assume that the attendant relations will be up to the highest obtainable standard for the purpose of discussion and to confine further discussion to the spark plug problems as they face the designers of automobile motors.

Magneto Work Is Limited by Spark Plug Action

Prior to the introduction of the magnetos in ignition work it was thought that spark coil imperfections were entirely to blame for the poor results that were frequently obtained. It is admitted, of course, that a good magneto is a superior device as compared with a poorly designed spark coil, and practice seems to indicate that magnetos are more reliable than spark coils, taking them as a whole. In the meantime gas engineers have expended nearly all of their energies perfecting the motor, and magneto engineers have busied themselves with the magneto, but it is not certain that spark plug engineers have kept pace with the other improvements. It is not uncommon to hear it stated that a magneto is capable of delivering 10,000, 20,000 and even 30,000 volts at the terminals of the spark plug, but in making these declarations informants fail to point out that the same magneto will fail utterly unless the spark plug is capable of withstanding the electrostatic stresses that go with these voltages. If the insulation of the spark plug breaks down at 2,000 volts, the magneto will be relieved of its induced electromotive force at this point, and no matter how good the magneto may be it cannot build up a volt of pressure after the spark plug breaks down. It is the same thing as pumping water into a tank that leaks; if the leak has a greater capacity than the pump, the water will run out as fast as it is pumped in; but if the leak is less commodious, water will accumulate in the tank.

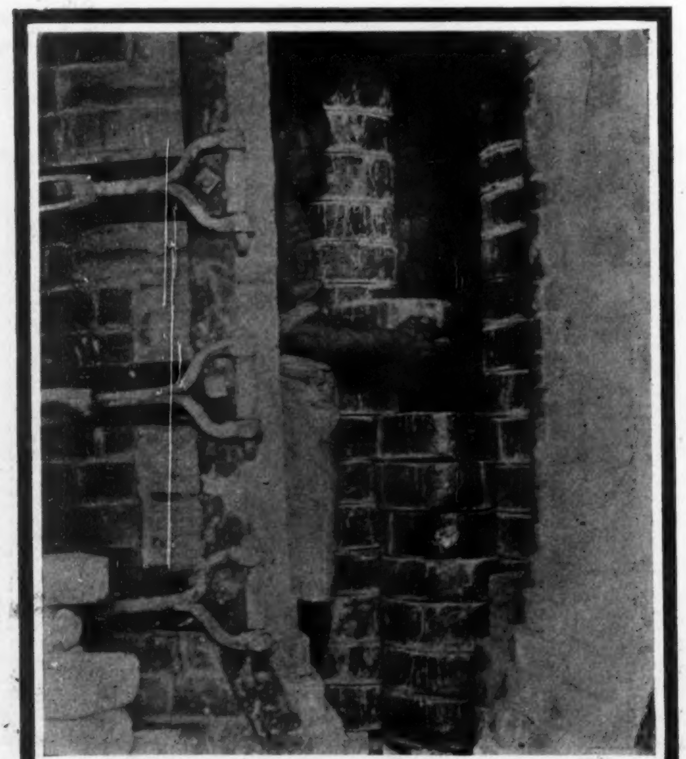


Fig. 6—Showing the seggars being placed in a kiln preparatory to being burned.

In order to show that the present limitation is in connection with spark plugs rather than due to poor carburetion or inferior magnetos, tests as follows are submitted, they being but a few of a considerable number in hand, and they show in a forceful way that the improvements of the immediate future of automobile motors lie in the perfection of the spark plug used therein, more than in the improvement of any other of its component parts.

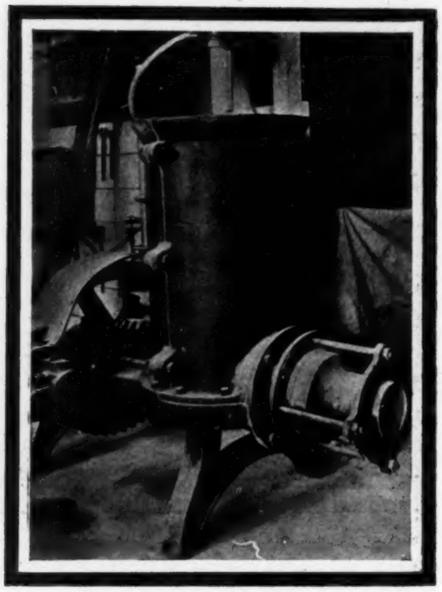


Fig. 7—Showing a pug mill, by means of which the clay is rolled free from air and made ready for the storage bins

HIGH POTENTIAL TESTS—I.

Three similar and apparently new spark plugs, numbered 1, 2 and 3, were submitted for test.

The following tests were made:

(1) To determine arcing voltage across the spark gap.
(2) To determine breakdown voltage with outer shell in place, and mica between the spark gap terminals.
(3) To determine breakdown voltage with outer shell removed.

Cycles: 60 capacity of transformer (k. v. a.): 1.5 ratio 54:1.
Voltage measured by voltmeter connected across low-tension side in connection with ration of transformation.
Time voltage applied, seconds (approx. 10.)
Room temperature: 75° Fahr. Humidity 49 per cent.

Test made with sine wave potential. Values given are mean effective (square root of mean square).

RESULTS OF TESTS

(a) Volts required to produce arcing across the spark plug.

Sample number	Volts required*
1	2,200
2	2,200
3	2,500

(b) Voltage applied between screw binding post and iron bushing with a piece of mica inserted in spark gap to prevent arcing at this point.

Sample number	Test number	Volts at "arcing over"†
1	1	5,810
	2	5,600
	3	5,650
	4	5,860
	5	5,650
	Average =	5,700
2	1	4,780
	2	5,260
	3	5,400
	4	5,140
	Average =	5,150
3	1	4,670
	2	4,620
	3	4,600
	Average =	4,630

(c) Voltage applied between screw binding post and brass sleeve, the shell having been removed.

Sample number	Test number	Volts at arcing‡
1	1	9,600
	2	9,720
	3	9,600
	Average =	9,640
2	1	8,750
	2	8,750
	3	8,750
	4	8,750
	Average =	8,750
3	1	8,500
	2	8,650
	3	8,020
	4	8,500
	Average =	8,420

*Average of several tests, approximate only. The voltage rises at each successive trial if the terminals are not allowed to cool down in the interim. The values obtained varied from about ten per cent. below to ten per cent. above the values given.

Attention is also called to the fact that the distance between the spark gap terminals is not fixed, but will be different every time the shell (bushing) is removed and replaced.

†Arced from stem to inside surface of shell in each case.

‡Arced from terminal stem to brass sleeve in each case.

Fig. 8—Showing the blanks in the process of turning, using soft steel for tools

TEST II.—One spark plug was submitted. The object of the test was to determine the arcing or breakdown voltage between the terminal and the metal parts under the two conditions given below.

The first high potential test on the spark plug was made by applying an alternating voltage between the electrode and the shell with a sheet of mica between the regular sparking points.

The second high potential test on the spark plug was made by applying an alternating volttage between the electrode and the metal sleeve which normally carries the shell, the latter having been removed.

The voltages were applied at a low value, raised gradually, and the effect noted. The approximate time which elapsed between the point where the voltage reached an appreciable value and that of arcing over was about ten seconds.

The transformers used had a capacity of four kilo-volt amperes, and nominal ratios of 54 and 108 to 1. The voltage was measured by a voltmeter across the low tension circuit, in connection with the ratio of transformation.

The source of the current was a sixty-cycle circuit, the voltage wave form of which is practically a sine curve. The voltages given are effective (square root of mean square) and not maximum values.

The spark plug was cleaned by wiping carefully with a cloth.

RESULTS OF TESTS

Test on Spark Plug with Shell in place

Test number	Volts Applied	Remarks
1	4,450	Arced from terminal stem to shell
2	4,290	" " " " " "
3	4,180	" " " " " "

Test on Spark with Shell Removed

Test number	Volts Applied	Remarks
1	8,000	Arced from terminal stem to sleeve which supports shell
2	8,000	
3	8,000	

Room temperature, 24° Cent.

Spark Plug Manufacture but Little Understood

An examination of the technical literature devoted to the automobile art discloses absolutely nothing in relation to the manufacture of spark plugs. These relatively small and unimportant looking devices, costing but a dollar or two at the outside, are looked upon by the average automobilist as a mere trinket, more often than not, whereas when the truth is told a magneto costing in the neighborhood of $100 is utterly worthless for its intended purpose unless the little spark plug is capable of resisting the electrostatic strain put upon it up to the point where the energy represented in the gap during the instant of disruption is enough to set fire to the mixture so vigorously as to cause it to burn to complete combustion within less than the tenth part of a second under ordinary conditions. Referring to Fig. 3 of the materials used in the production of porcelain, they are shown as kaolins, silicates, feldspar and oxides, as they are taken from the mines abroad, for the most part, and the electrostatic qualities of the finished product will depend to a large extent upon the qualities of these materials, to some extent upon their proportioning, and for the rest upon the care with which the steps in the process of manufacture are conducted. Fig. 10 shows a portion of equipment in the laboratory of the Jeffery-Dewitt Company, Detroit, Mich., and the photographs as here presented, showing the process throughout, were also taken from the same establishment by the staff photographer of THE AUTOMOBILE for the purpose of illustrating the several phases of the process and to convey to the reader something of the extent of the work in order to get him to appreciate the fact that the importance of a spark plug is not represented by its cost, but by the fact that it must interpret the magneto and deliver a considerable quantity of energy at a high temperature to the gas body in order to ignite it quickly and make it burn at a rapid rate. Referring to Fig. 10 again, it is pointed out that the laboratory equipment in an establishment of this description must be quite complete, and experiments are being conducted from day to day always with the expectation that there is room for improvement. In this connection it will be difficult perhaps to eliminate from the mind of the average reader the fact that a "fat" spark or a "lean" spark is a fallacy, and it will be equally difficult to get the reader to understand that what is required is the delivery of a considerable amount of energy at a high temperature. Theoretically this energy could be delivered by a hammer blow against an anvil. When a hammer impacts with an anvil the energy of impact is dissipated in the form of heat for the most part and vibrations for the rest. The reason why a hammer and anvil would not serve as an ignition equipment is because the temperature resulting is relatively low as compared with the electric arc. The hammer blow has more energy than the electric arc under the conditions that obtain in spark-plug work, but the temperature due to the disruptive discharge at the nodes of the spark gap is high enough for the intended purpose. The great plan is to dissipate as much energy as possible at this high temperature. The quantity of energy dissipated at the gap during the disruptive period cannot be gauged by the eye of the observer, nor is it possible to say that a "fat" spark or a "lean" spark have virtues over each other in this regard. In the laboratory experimental spark plugs are made as fast as new ideas of merit are perfected, and by actual trial and test the ability of a spark plug is determined, first, by finding out its break-down voltage, and, second, by ascertaining the amount of energy that can be dissipated in the gap.

Referring to Fig. 12 of the "wedging" process, it will be seen that the operator is halving the mass of clay by means of a fine wire, after which he lifts one-half well above his head and brings it down upon the other half on the block, repeating this process of halving, etc., until all traces of air are removed and the clay mass is rendered homogeneous. It will be readily understood that the personal equation is a large factor in the manufacture of spark plugs. It would be useless to go to far-away countries for kaolin, feldspar, etc., and to bring them into a well-equipped plant for the purpose of manufacturing good spark plugs if for

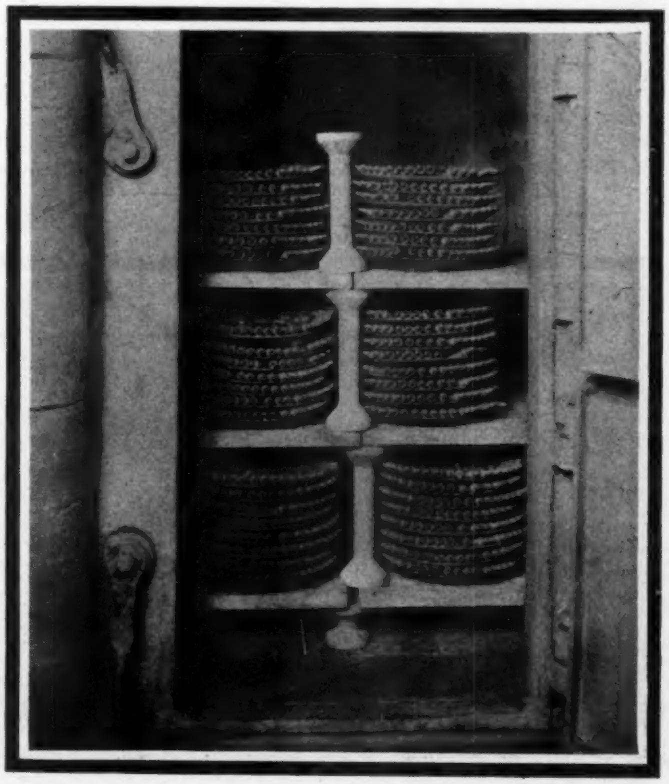


Fig. 9—The decorated ware on plates stored in a muffle furnace ready to be burned

no better purpose than to allow an indifferent operator to tire of repetition in the wedging process, since the electrostatic ability of the porcelain depends to a very large extent upon the exclusion of air and upon homogeneousness.

An early process in the preparation of the clay mass is shown in Fig. 1, presenting the filter press, and indicating the "slip" as it enters the canvas bags and the removing of surplus water, leaving the clay at about the consistency of putty. The pug mill is shown in Fig. 7, and it is in this mill that the clay is forced through a train of powerful geared sweeps and worms where it is worked to give it consistency and to free it from air so that it will be ready for the storage bins.

Fig. 11—Operator preparing blanks for magneto porcelains, showing the different stages from the blank to the fitting

After the clay comes out of the wedging process it goes to the throwing room, as shown in Fig. 2, where it is made into balls and then placed on the throwing wheel in the room in the form of a disc rotating on a vertical spindle, during which process the clay is given its cylindrical shape of a length and diameter conforming to the requirement of the piece that is to be subsequently turned from the blank. The blanks so formed are allowed to partially dry and are then placed in damp boxes ready for turning. In due course the blanks are taken from the damp boxes and turned, as shown in Fig. 8. In this condition they work up with the same facility as is represented in the turning of wood or other material, and the tools used in turning are made of soft steel filed to shape. The workmen use calipers in sizing the blanks as they are being turned down, and experience gives them a certain deftness which permits them to operate at high speed.

It is important that the sizing be done with some accuracy, but it must be remembered that the glaze will take up some room, thus adding to the diameter, and it is also true that the blanks will deform more or less during the burning process, for which allowance must be made.

After turning, the blanks go to the dipping room, as shown in Fig. 5, and they are then subjected to a drying process and subsequently in a thin "slip" known as glaze. This glaze is composed of materials such as will make a high fusing glass, keeping in mind the idea that the coefficient of expansion of this glass must check with the same coefficient of the plug proper. At the proper time in the process the turned and dipped product is placed in "seggars," in other words, clay crucibles, as shown in Fig. 14, preparatory to being placed in kilns. Each seggar holds about 180 pieces; the pieces must be so placed in the seggars that they will not contact with each other. These seggars when filled are placed in kilns, one of which is shown in Fig. 6. When the kilns are filled with seggars the opening or doors in each case is bricked up, using massive firebrick, and upon thoroughly luting the same with clay, bands are drawn securely around the kilns, and fetched up tight by means of turnbuckles. The next process is to fire the kilns, raising the temperature to about 2,600 deg. Fahr. Much skill is required in the regulation of the firing process; the temperature must be maintained evenly for the required period of time, and the operator must be skilled in the art in order that he will know when to discontinue the burning process. Upon completion of this process it remains for the kilns to be cooled down at a sufficiently slow rate to assist in the annealing process, and it is in the exercise of judgment of the burner as to whether or not re-annealing will be necessary and to what extent this process will have to be conducted.

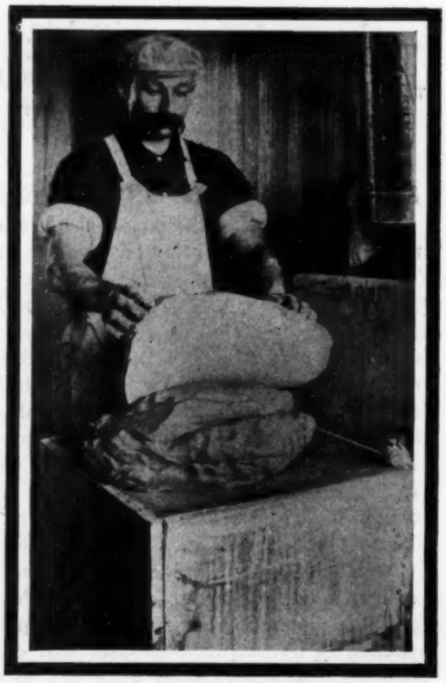


Fig. 12—Depicting the process known as "wedging" to work out air bubbles and reduce the mass to a homogeneous form

Fig. 10—Showing corner of laboratory, where porcelain materials are tested

The process of decorating the porcelain is one that requires a considerable amount of care and attention; moreover, it is quite possible that the electrostatic qualities of the porcelain may be injured during this decorating process, so that it is necessary

Fig. 13—In the decorating department, where the trade marks are transferred from copper plates to the porcelains

to consider well the placing of the decorations. Fig. 13 is a view of the decorating department where the enamel is transferred from copper plates in the process of fixing the trademark upon the porcelain. Fig. 15 shows the method of placing the decorated ware on plates prior to putting it into the kiln, and Fig. 19 shows the decorated ware as it is stored in the kiln. These kilns are of the muffler type, each having a capacity of about 25,000 pieces, and in the burning process the temperature is raised so that the pieces partake of a high red heat. Then comes the plating room where the shells are nickel-plated and the brass parts are buffed and lacquered. Fig. 4 shows the assembling room where the porcelain and metal parts are brought together and the spark plugs are assembled, tested and packed, each in a separate carton, and the cartons into boxes ready for shipment. This is a very important commercial detail.

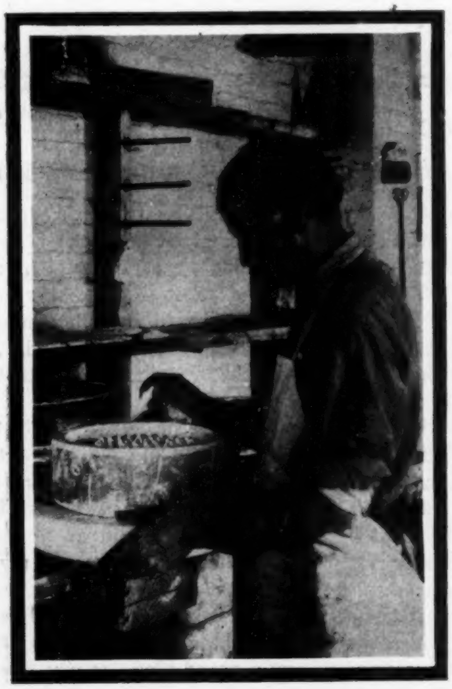


Fig. 14—Where the dipped blanks are placed in seggars ready to go into kilns

No attempt has been made to illustrate and discuss the metalwork department in the manufacture of spark plugs.

Body Color—How It Is Applied

In the paint shops and garages wherever, as a matter of fact, the automobile is piloted to be dressed up in a new garb of paint, color, and of varnish, the rule may well be taken to heart, to adhere to rich, plain colors, dainty relief lines and a finish of the very handsomest sort.

This kind of finish is for the most part, rather vaguely understood, and so far as we know, it has hitherto not been definitely detailed in the columns of The Automobile.

In anticipation of the season for "shaping" up the cars, and putting them in "trim" for the strife of service, it is due here to say that in the first place avoid piling on the varnish, as some authorities sense the term. Get the surface as clean, and smooth, and as level as possible before working out the field of color. Defects in the surface are hard to eliminate after putting on the color coats.

To conceal them it is often necessary to face up the defects with putty, rub them down with a block of rubbing stone and water, and apply a fresh coat of color to the entire panel.

The color should be put over the surface in a clean, spick and span condition, free from kernels of dirt or motes of dust and left in a clean place to dry.

A good surface condition having been provided the varnisher comes to his share of the work charged with the responsibility of making good.

The first step is to get the varnish color or the glaze coat, as the case may be—this choice of materials depending upon the color floated over the surface free from sags or runs and dust as possible. When dry whip the gloss off from this coat with a small soft sponge moistened and dipped in pumice stone flour.

Wash up and apply a free rich coat of rubbing varnish into which should be stirred enough of the field color to maintain the purity and original tone of the color. In other words, aim to counteract the discoloring effects of the varnish. Let this coat dry hard and fine whereupon rub with pumice stone flour and water to a clean, smooth surface. Wash up and apply any striping or other ornamental work desired. Then over this, when dry, lay on another coat of rubbing varnish, omitting the color on account of spoiling the ornamental effects.

When this final coat of rubbing—an additional rubbing coat being desirable only in case of the highest class of work—becomes hard enough to surface nicely proceed to rub with pumice stone flour and water, finishing off by rubbing with the felt pad dipped in water only. Wash very clean and thorough and apply a coat of elastic body finishing varnish.

Fig. 15—Showing the decorated porcelains placed on plates preparatory to putting them in muffle furnaces

Some Pointed Injunctions

Don't Gather the Impression That This Series of Short Statements of Fact Will Hold Nothing of Value to You; Read, Think, Analyze, and if You Do Not Find a Festoon of Ideas That Can Be Applied to Your Situation, You May at Least Find One Expression That Will Jog Your Memory

Don't look backwards for your example of how to deliver merchandise excepting to find out how mistakes are made so that their repetition may be avoided.

Don't gather the impression that your competitor is being dragged down by modern methods just because they look too swift for you; he soon gets used to speed after which he is equipped to pass you by.

Don't be a grave-digger; steeple-jacks are the class of men who make a success in business.

Don't try to do business with one good automobile for delivery purposes, holding the same back by means of 100 horse-drawn vehicles; could you get anywhere with 200 horses holding you back?

Don't throw your horse-drawn vehicles away; think it over and try to devise a plan by means of which they can be made to co-operate with your automobile delivery wagons—it is a reasonable possibility.

Don't think that you are sweet just because you sit upon a sugar barrel, or imagine that you know it all, basing your judgment upon the fact that the receiver did not call upon you yet; he will, in time, if you fail to take advantage of automobile delivery wagons.

Don't whine about it; become animate; buy enough automobile transports to enable you to deliver all the goods that you can get orders for—make deliveries the day the goods are ordered.

Don't forget that you can go faster and further if you purchase a wooden leg if you need one; proper means of delivering goods are your wooden legs; get enough of them to turn you into a centipede.

Don't mope; if you do not know what to do, ask someone who does; get the microbe of languor out of your system even if you have to use a crowbar.

Don't enter the race for supremacy with a "dray"; it is barely good enough for a darkey to use in the hauling of furniture.

Don't sing the song of despair; it reads like this: "Oh, what's the use! No sooner do I get the latest equipment than some later invention puts my equipment in the classification of the obsolete!" What of it? Be nimble! Let some other merchant become obsolete.

Don't let your early education, cramped and threadbare, if it is, anchor you to one spot on this mundane sphere. Look around; see how the wind blows; trim your sails to the steady and strong breeze.

Don't allow a horse-lover to pick out your automobile delivery wagons for you; if you do they will have spavins.

Don't rely upon logic as your guide in the purchase of a freight automobile. True, it will go very much faster than horse-wagons, but it is also a fact that it will last longer if it is not required to travel at a clip that will render it eligible to compete for the Vanderbilt cup.

Don't forget that logic is a stoic and ofttimes a falsifier; common sense, even horse sense, is better than logic; experience is also a great teacher.

Don't ever give up; if you feel whipped, call it by another name; struggle on; keep hammering away; the other fellow will either give up or he will back away and make his low bow.

Don't forget that the fellow who shouted "Eureka" when he found a gold mine, was so busy shouting that he allowed another fellow time in which to hustle back to the county seat and "stake" the claim.

Don't forget that what you require is a "wireless" connection between you and success.

Don't take off your hat to success; get a bear-trap and bait it for that far-famed beauty.

Don't become dazed when you gaze on her countenance, and in admiring the fineness of texture of her hair, the sweetness of her smile and the winsome look in her eye, imagine that sweet success is not for you; she is ever the companion of the brave.

Don't dominate a situation that is described in geography as a desert; if you see what you want; if you know your need; if you have the breath of life in you, reach out; grasp the plot of earth that has the flowing stream and the fruit that feeds the energetic.

Don't envy the man who is getting along; true, you may be of broader cast; equally true, he may be more energetic.

Don't be too fond of patience; a speaking acquaintance with her is enough; she is not on good terms with success.

Restful Roscoe

Telling How to Acquire an Automobile without Purchasing or Purloining It

THE Canyon Diabolo crevice of Restful Roscoe's shredded character was a mere scratch as compared with the reputation he accumulated for wanting things that other people were possessors of. There was a time when Roscoe merely wanted to be released from an irksome sojourn in jail, where he went at the earnest solicitation of a very considerate judge, who maintained with some vehemence that Roscoe should take a vacation after a hard season's work.

That jail is no place for genius Roscoe is a firm believer; when he was younger and unsophisticated he thought out the brilliant plan of marrying, for, said he, "work makes a man round-shouldered; girls pad and don't show their true shape; it's a good looker for me, but she must be strong and not afraid of work, for then I shall be able to preserve the squareness of my shoulders and the fatness of my purse without working."

Time withers the most beautiful flower in the garden, and in the long run Roscoe's idea shriveled up; his wife refused to be the perpetuator of what seemed to him a grand idea. It was due to this great disappointment that Roscoe wore such a hole in his reputation that the good judge sent him on a vacation. At all events, as the story goes, the hands of the clock kept going around and round until one day the accommodating keeper of the jail strongly intimated to Roscoe that his welcome was at an end.

Thrust out on a cold world, with wife and prospects gone, our hero resolved to try something with less risk in it; his faith in women was shattered, jail had its drawbacks, and after looking the situation squarely in the face, Roscoe decided that what he really needed to make him happy was an automobile, provided some other person would feed, lodge, clothe and pamper him, besides paying for gasoline, lubricating oil and tires. To purloin a

car would be simple enough, but such an act would be too crude for a person who posed as a genius, and especially one who had such a good record at his back. Then, in purloining there were all the elements of another trip up the river.

It took Roscoe a whole day to think up a plan by which he could own an automobile without having to pay for it. How to get a job as chauffeur for some dub of a rich man was all that Roscoe had to figure out, and he soon came to the conclusion that there is no jail sentence attached to lying and misrepresenting. It was a brilliant idea; by looking about a little Roscoe was able to pry up a job as a chauffeur in the family of a "newly rich" pork packer; the lady of the house wanted a French chauffeur, and not being able to understand Roscoe's lingo, took him for a Frenchman, hiring him on the spot. Roscoe took charge of his automobile without a moment's delay. "What a great world this is," said he, "what a chump I was to marry a laundress to get a few dollars a week when all I have to do is to say I am a chauffeur and some rich philanthropist presents me with an automobile and, what is more to the point, pays all bills, leaving it to me to collect a commission on tires, lamps, and a lot of other things that I do not need, but I do need the money.

"There is just one thing that I don't like about this situation; there are times when I am pestered too much for the loan of my automobile, not that I am unaccommodating, but it does get on my delicate nerves to have the woman who presented me with this automobile come around asking me to take her downtown, or around to meet another one like her; as for the old man, I am able to stave him off, to him the dinfiddle of the transmission spring has a leak in it; the subway for the likes o' him. I heard the old stunt say to a friend o' his'n, 'that automobiles are far from perfect.' I wonder if he thinks he can qualify as an expert? Why didn't he get my opinion?"

Relative Values in Steel

Its Value Depends Upon the Sulphur and Phosphorus Content As Well As Upon the Alloying Percentages

PURCHASING steel on a price basis is like buying eggs by looking at them from a distance; they may be good, but shaking tells the story. Referring to steel, while it is of course true that the nickel must be figured in at its market price, and the chromium must be accounted for, the fact remains that the mere presence of these or other alloying elements is not a sign of quality as it should be measured by discriminating buyers. It will be no fault of the purchaser if some particular fabricator of steel is not in a position to purchase suitable ore, or if he is lacking in the requisite facilities. It is the purchaser's right to select electrically refined steel, if it is the best product for him, or if some other method of fabrication will produce a sufficiently good result, then the difference in price would be worth considering. It will not be the purpose here to discuss the relative merits of the various methods of steel-making in vogue, but it is desired to point out that the purchaser pays a fixed price per pound simply because the nickel and chromium content, for illustration, are up to a certain point, is depriving himself of a better quality of material for the same price.

It seems to be the desire on the part of steel makers and their "agents" to school automobile engineers in the art of making good steel out of bad by a process of heat-treating. All shop methods of correcting the structure of steel are at the service of all users on an equal basis, whether the steel maker wills it so or not. There is no reason why an automobile maker should pay a steel mill anything for the privilege of installing a heat-treating plant for the purpose of correcting the structure of the material used. No matter how good the raw material is it should be heat-treated after it is forged to allay internal strains, and it should also be subjected to the heat-treating processes that will accentuate the qualities desired. But these are all well understood matters, excepting that purchasing agents do not seem to appreciate the fact that while the steel salesman is taking up their time telling about what heat-treatment will do, he is blinding them to the fact that the sulphur and phosphorus content in their material is higher than its price warrants.

There is no objection to the presence of a relatively considerable percentage of sulphur and phosphorus in steel as used for many purposes. In automobile work the life of the parts will be long or short, depending upon the absence or presence of sulphur and phosphorus. The table here given is offered to illustrate the relative value of steel under changing conditions of sulphur and phosphorus. Its use will be readily understood, but for the purpose of making the point as clear as possible, attention is called to one of the grades of steel as follows:

Take the grade marked A showing 0.90 to 1.10 of chromium, 5 to 6 per cent. of nickel, and carbon ranging between 0.10 and 0.20 points, the value is given as 100 when the phosphorus and sulphur are below 0.015 per cent. But should the phosphorus and sulphur be in the region of 0.025 per cent. then the value of the steel will be reduced in the scale to 94, and with the sulphur and phosphorus content increasing to 0.035 the relative value of the steel may be considered as 87.5. It has not been considered desirable to determine the relative value of steel with sulphur and phosphorus abov 0.035, although in bridge work these contents are specified as maximum at 0.040. Automobile engineers will no doubt remember that bridges do not roll around on wheels.

COMPARATIVE VALUE FOR CRUCIBLE OR ELECTRO STEEL WITH							COMPARATIVE VALUE FOR OPEN HEARTH STEEL WITH		
No.	CHROME	NICKEL	CARBON	PHOSPHORUS AND SULPHUR NOT OVER			PHOSPHORUS AND SULPHUR NOT OVER		
				.015%	.025%	.035%	.015%	0.25%	.035%
A	.90 to 1.10%	5 to 6 %	.10 to .20%	100.	94.	87.50	62.50	58.25	50.
B	.90 to 1.10%	4 to 4.5%	.10 to .20%	94.	87.50	81.25	58.25	50.	44.
C	.90 to 1.10%	3 to 3.5%	.10 to .20%	87.50	81.25	75.	50.	44.	37.50
D	.90 to 1.10%	2.5 to 3 %	.10 to .20%	84.50	78.25	72.	47.	40.25	34.25
E	.90 to 1.10%	2 to 2.5%	.10 to .20%	81.25	75.	68.75	44.	37.50	31.
F	.80 to 1.00%	3 to 3.5%	.40 to .50%	81.25	75.	68.75	44.	37.50	31.
G	.80 to 1.00%	1.5 to 2 %	.40 to .50%	72.	65.50	59.50	34.25	28.	21.75
H	....	5.5 to 6 %	.10 to .20%	94.	87.50	81.25	58.25	50.	44.
I	....	5 to 5.5%	.10 to .20%	89.	82.75	76.50	50.	44.	37.50
J	....	4 to 4.5%	.10 to .20%	82.75	76.50	70.25	44.	37.50	31.
K	....	3 to 3.5%	.10 to .20%	76.50	70.25	64.	37.50	31.	25.
L	....	2 to 2.5%	.10 to .20%	70.25	64.	57.75	31.	25.	19.
M	....	5.5 to 6 %	.30 to .35%	90.75	84.50	78.25	53.	47.	41.
N	....	3 to 3.5%	.30 to .35%	73.50	67.25	61	34.50	28.50	22.
O	Plain Carbon Steel			62.50	58.25	50.	16.50	15.	13.

Compiled by Jos. Schaeffers.

Castellated Shafts

PAPER READ BY MR. C. E. LARARD AT THE JANUARY MEETING OF THE ENGLISH INSTITUTE OF AUTOMOBILE ENGINEERS; ABRIDGED FROM THE COMMERCIAL MOTOR

SQUARE shafting was introduced when Levassor made the first gearbox with its system of clash gearing, and it is still used, with the edges rounded off, to a suitable extent, in a good many cars. Other makers have used long keys pinned in key-ways cut in the shaft, or alternatively projecting keys pinned directly onto the shaft.

The best and the latest practice, however, is to use castellated shafts similar to those tested and here reported upon by the author, or alternatively shafts of the form shown in Fig. 3. In either case the grooves and key-ways in the sleeve or boss are cut out so as to leave solid projections or keys corresponding to and fitting in grooves or key-ways in the shaft. In every case where gear wheels are moved into engagement there must be no constraint with respect to axial movement along the shaft, while at the same time the fit should be good enough to prevent rotational play of the wheel on the shaft. If the first condition is to be fulfilled, it follows that the shaft should be made stiff enough, i. e., its diameter should be large enough so that when the maximum torque is brought to bear upon the shaft it should not cause spring or twist sufficient to result in binding between the shaft projections and the sleeve or boss of the wheel. It is well known in general engineering practice that if the spring is to be taken into account the diameter found by calculation is larger than it would be if the strength or resistance of the shaft alone were considered, and the motor car manufacturer has also found that gearbox shafting should be designed from considerations of stiffness rather than from those of strength.

Motor car manufacturers have found from experience that in some cases shafts have taken a slight set, rendering it difficult to slide the gear sleeves along without considerable friction, and so it is becoming the practice to use comparatively heavy shafts as compared with the power transmitted. The author's experiments have shown that the exact torsional limits of elasticity for shafting are much lower than the figures representing yield points, which are published in works dealing with the strength of material, and thus to some extent account for this heavier shafting, which experience has shown to be necessary.

In addition to the torsion, the bending action in the case of gearbox shafting due to the load on the teeth of the wheels is another factor adding to the difficulty of arriving at suitable dimensions of shafting for a car of given power. Though in some cases the effect of the gear sleeves is to stiffen up the shafts to the extent of spreading the bending load, in any case the maximum bending moment as well as the maximum twisting moment should nevertheless be considered in fixing the dimensions of the shaft.

With respect to the kind of material used for gearbox and clutch shafting, soft mild steel seems hitherto to have been the favorite, and steel containing about 0.15 of one per cent. carbon is very useful for case-hardening, which at the present time seems to be a practice adopted in order to prevent the development of slackness between the shaft and the boss. The various forms of the alloy steels are, however, being used in addition, notably a steel containing about three per cent. of nickel. The elastic limits of such alloy steels are considerably above those of mild steel, and in the case where the material has been oil-hardened or treated the limit is much above that for the same kind of material when tested in the ordinary untreated condition.

The desirability of making torsion tests on shafting, both of the plain and castellated forms, before building it up into the motor car does not yet seem to be fully realized—it is thought by some firms quite sufficient to make occasional tensile tests. First-class firms may, and perhaps do, in the case of crankshafts have a tension test made on a piece of steel cut from each shaft, and as to the wisdom of this course, failing a torsion test, there can be no doubt whatever. The author has tested a large number of specimens cut from motor car crankshafts and has been considerably surprised at the immense difference in the behavior of different specimens prepared from the same charge —the results showing both very ductile and very brittle conditions of material. Although comparative results of value are obtained from tension tests of material to be used as shafting, yet undoubtedly results of more practical value would be obtained from the testing of the material for that kind of stressing action to which it is to be subjected in regular work when used installed in an automobile. There is, further, the strong probability that tension and torsion tests will be found in some respects to be complementary.

Specification for Torsion Test.—Taking for granted, then, that the torsion test is more valuable than the tension test in such cases, the question arises as to what results should be given in a report or required by a specification. The author

TABLE I.—RESULTS OF TESTS UPON MILD STEEL PLAIN AND CASTELLATED SHAFTS

No. of Specimen	Form of Specimen	Diameter of Specimen: Outside	Diameter of Specimen: Bottom of Keyway	Particulars of Keyway: Width	Particulars of Keyway: Depth of Edge	Limit of Elasticity in Pound-Inches	Ratio of Elastic Torque to Elastic Twist	Modulus of Rigidity: Pounds per Square Inch	Modulus of Rigidity: Tons per Square Inch	Diameter of Equivalent Elastic Shaft	Elastic Resilience to Limit of Elasticity in Inch-Pounds: Per Unit Length	Elastic Resilience: Per Unit Volume	Torque at Fracture in Pound-Inches	Work to Produce Fracture in Inch-Tons: From Instrument Readings on 8 in.	Work to Produce Fracture: Per Unit Length	Work to Produce Fracture: Per Unit Volume	Ratio of Total Plastic Work to Elastic Resilience	Angle of Torsion: By instrument on 8 in. Length	Angle of Torsion: Per Unit Length	Angle of Helix
		in.	in.	in.	in.					in.								deg.	deg.	deg. min.
108	Castellated	2½	2	½	7/32	16100	53080	—	—	2.144	5.266	1.251	135000	457.16	57.14	13.58	24300	545	68.1	33 57
109	Plain......	2	—	—	—	14800	40000	11.68×10^6	5215	—	5.970	1.9	90800	438.6	54.83	17.44	25890	740	92.5	41 29
110	Castellated	1 57/64	1 33/64	7/16	3/16	7400	17420	—	—	1.623	3.429	1.484	57700	257	32.12	13.89	20980	708	88.5	34 17
111	Plain......	1 23/64	—	—	—	6400	13720	12.01×10^6	5380	—	3.256	1.804	41600	281.5	35.19	19.51	24200	1034	129.25	30 20
112	Castellated	1⅝	1⅜	11/32	⅛	4430	9166	—	—	1.382	2.334	1.283	38000	161.7	20.21	11.10	20490	690	86.25	39 16
113	Plain......	1 11/32	—	—	—	4850	8387	11.79×10^6	5265	—	3.049	2.127	28100	195.6	24.45	17.07	17960	1040	130	33 9
114	Castellated	1¼	1	¼	⅛	2750	3300	—	—	1.070	2.498	2.39	16550	101.1	12.64	12.11	11330	999	124.9	36 17
115	Plain......	¾	—	—	—	2680	2568	11.47×10^6	5120	—	3.048	3.812	11700	122.6	15.32	19.16	11260	1563	195.4	30 9
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

suggests the following as covering all results of practical importance:

(1) The torque at the elastic limit and, for cylindrical specimens, the corresponding shear stress at this limit.

(2) The ratio of the torque to the angle of twist for the elastic period together with the angle of torsion at the elastic limit.

(3) The elastic resilience or work per unit length and per unit volume at the elastic limit of the specimen.

(4) The maximum torque.

(5) The ratio of the torque at the elastic limit to the maximum torque.

(6) The total work per unit length and per unit volume required to twist the specimen to destruction.

(7) The ratio of the total plastic work to the elastic work.

(8) The angle of torsion per unit length and the angle of the helical lines of twist.

(9) The appearance of the fracture.

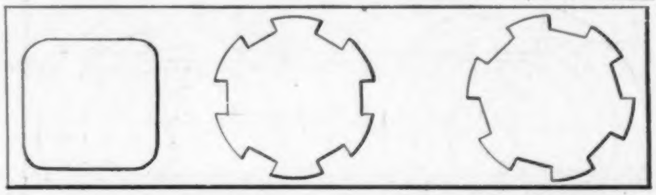
The author gives the results of some torsion tests on two qualities of material, mild and nickel steel; with the former the tests were made on solid cylindrical and castellated specimens and with the latter on castellated specimens tested in the normal condition and after oil-hardening. The complete numerical results for the mild steel specimens are given in Table I., and for the nickel steel specimens in Table II.

The principal objects of the experiments on the mild steel specimens were to determine (1) the effects produced on the elasticity and strength by castellating or grooving the shafts: (2) the equivalent diameter of a solid cylindrical shaft which would have the same angle of torsion at the elastic limit as the castellated shaft, or in other words, the diameter of a shaft which would have the same value of the ratio elastic torque to twist; (3) if possible, the diameter of a solid cylindrical shaft which would have the same moment of resistance as the castellated one.

For this series of experiments four pairs of specimens were prepared, one specimen in each pair having six key-ways, while the other specimen was a plain cylinder with a diameter the same as that at the bottom of the key-ways for the castellated shaft. The largest castellated shaft was 2 1-2 inches outside diameter with the corresponding plain specimen 2 inches diameter, and the smallest castellated shaft was 1 1-4 inches outside diameter with the plain specimen 1 inch diameter. The angular extent of the key-ways is shown in Figs. 4 and 5.

As will be seen by reference to the tables, the dimensions given both for the mild steel and the nickel steel specimens fully cover those used for shafting embodied in the construction of a chassis, and this being so it is hoped that the test results will be of considerable practical value.

Mild Steel Test Results.—Comparing the figures for the several pairs of the elastic limits given in column 7, Table I.,



Figs. 1, 2 and 3—Typical forms of gearbox shafts

it will be seen that in each case the limit for the plain specimen, whose diameter is the same as that at the bottom of the keyway of the castellated shaft, is somewhat less than that for the castellated specimen, showing, as might be expected, that a little additional strength is afforded to the larger shaft by the projections. This result is borne out, too, by a comparison of the torques at fracture given in column 14, where in each case the torque at fracture for the castellated shaft is greater than that for the corresponding plain shaft. When, however, we come to compare the work required to fracture the material we find that, with one exception, more work is required to fracture the plain specimen than the corresponding castellated specimen, from which it may be inferred that in the ultimate part of the test the castellations become a source of weakness.

In order to find the equivalent elastic shaft or the diameter of a shaft which will give the same spring or angle of torsion as the castellated shaft for values of torque up to the elastic limit we must take the usual formula for the rigidity modulus for a plain cylindrical shaft and evaluate for the diameter—substituting in the formula the value of the ratio torque-twist found experimentally for the castellated shaft, and this is tabulated in column 8.

This is shown symbolically as follows:

$$G = 584\ TL/a\ d^4.$$

$$\because\ de = \sqrt[4]{584\ L/G \times T/a}.$$

The values of T/a taken are the numbers given in column 8, Table I. Comparing the equivalent diameters (column 11) obtained in this way with the inside diameters (column 4) for the castellated shafts, it will be seen that the former are a little greater than the latter. Fig. 5 gives the plottings for the equivalent diameters (de) as ordinates with the corresponding full diameters (D) for the castellated shafts as abscissæ. The equation to the line obtained is:

$$de = 0.857\ D, \text{ or}$$

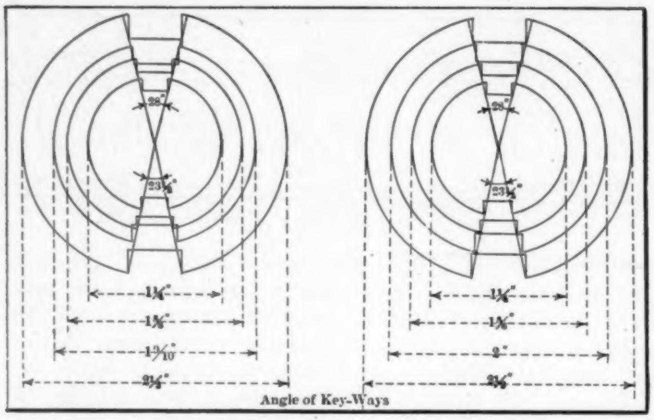
$$D = 1.167\ de.$$

These formulæ are true for this series of mild steel specimens, where, as will be seen by reference to Figs. 4 and 5, all the keys for shafts of different diameters are defined by an angle of 28 degrees. Equations may also be obtained giving the diameters of equivalent solid shafts having the same moments of resistance as the castellated ones.

Nickel Steel Test Results.—Dealing next with the nickel

TABLE II.—RESULTS OF TESTS UPON NICKEL-STEEL PLAIN AND CASTELLATED SHAFTS

No. of Specimen	Treatment of Material	Diameter of Specimen		Particulars of Keyway		Limit of Elasticity in Pound-Inches	Ratio of Elastic Torque to Elastic Twist	Diameter of Equivalent Elastic Shaft	Elastic Resilience to Limit of Elasticity in Inch-Pounds.		Torque at Fracture in Pound-Inches	Work to produce Fracture in Inch-Tons			Ratio of Total Plastic Work to Elastic Resilience	Angle of Torsion		Angle of Helix
		Outside	Bottom of Keyway	Width	Depth of Edge				Per Unit Length	Per Unit Volume		From Instrument Readings on 8 in.	Per Unit Length	Per Unit Volume		By instrument on 8 in. Length	Per Unit Length	
		in.	in.	in.	in.			in.								deg.	deg.	deg. min.
100	Normal........	2½	2	½	7/32	41800	52810	2.162	36.079	8.56	226200	174.09	21.76	5.165	1351	123	15.4	71 26
101	Oil Hardened..	2½	2	½	7/32	78100	52080	2.154	127.95	30.39	265200	460	57.5	13.66	1007	268	33.5	53 51
102	Normal........	[illegible]	[illegible]	7/16	3/16	23000	17250	1.634	33.43	14.46	107200	140.5	17.56	7.6	1773	204	25.5	67 5
103	Oil Hardened..	[illegible]	[illegible]	7/16	3/16	39600	17100	1.630	100.022	43.4	116000	370.4	46.3	20.03	1037	452	56.5	46 52
104	Normal........	[illegible]	[illegible]	[illegible]	⅛	11800	10270	1.435	14.783	8.12	68000	117.8	14.72	8.1	2231	276	34.5	63 56
105	Oil Hardened...	[illegible]	[illegible]	[illegible]	⅛	26800	10580	1.446	74.023	40.65	77000	289.9	36.24	19.91	1096	545	68.1	46 0
106	Normal........	1¼	1	¼	⅛	5900	3309	1.081	11.472	10.51	30360	70.6	8.76	8.38	1710	360	45.0	63 52
107	Oil Hardened...	1¼	1	¼	⅛	12200	3329	1.083	48.771	46.6	33400	113.9	14.24	13.62	654	522	65.25	54 34
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19



Figs. 4 and 5—Including angle of key-ways

steel specimens and the test results given in Table No. II, it will be noticed that in this series we have four pairs of specimens, those in each pair being of identical dimensions. One of each pair was tested in the condition (except for the machining) in which it was delivered from the forge, while the other was oil-hardened before machining and testing.

Column 7 gives the elastic limits in lb. ins. and column 10 the elastic resilience, and the first information of practical importance which we derive from an inspection of these test results is that the effect of the oil-hardening has been to raise the elastic limits to about double the values of those of the shafts tested in their normal bar condition, while the resilience or elastic spring energy has been raised to from three to five times that of the untreated shaft. This last result is, obviously, of very great importance, and worthy of more than passing attention in dealing with the treatment of shafting to be used for motor car work where considerable shocks and wide ranges of stress variation will be experienced.

A reference to column 8 will show that the ratio of elastic torque to elastic twist is practically constant for both treated and untreated specimens. This being so, it follows that the maximum elastic play energy consistent with full recovery of spring on removal of torque is directly proportional to the square of the torque at the elastic limit, and this result is further borne out by the figures referred to and given in columns 7 and 11.

The equivalent diameters of plain cylindrical shafts calculated in the same way as for the mild steel specimens, taking the value of the modulus of rigidity derived from previous experiments, are given in column 9; and the plottings for these equivalent diameters and the full diameters for the castellated shafts are given in Fig. 7. The equation to the line obtained is:

$$de = 0.867\,D, \quad \text{or}$$
$$D = 1.154\,de.$$

Similar equations may be found for plain cylindrical shafts of equivalent strengths or moments of resistance.

Finally, considering the remainder of the figures given in columns 12 to 19, some interesting results may be gathered from the tests on oil-treated specimens as compared with those from the untreated ones. First, the torque to produce fracture is appreciably greater, and the unexpected result that the angles of twist for the treated specimen are of the order of twice the magnitude of those for the untreated ones (see column 17). These angles are in agreement with the helical angles of torsion in the last column. The increased values of the torque and the angles of torsion together result in more work being required to fracture the oil-hardened specimens than the untreated specimens.

The figures given in column 16, Table II, and in column 18, Table I, are also of importance. From the nickel steel specimens the elastic spring energy varies from about 1-1,000 to about 1-2,000 of the total work necessary to destroy the bars, which is a much more useful result from a practical point of view than that obtained for the mild steel specimens where only from 1-11,000 to about 1-26,000 of the total work energy in the bar is available for electric spring.

Configuration of Material during Testing.—In order to enable the eye to follow the kind of straining action which the specimens had undergone during twisting, the author had the mild steel specimens striped longitudinally on the surface by six black lines equally spaced round the circumference, while circles were painted round the circumference at one-inch distances apart along the length. The castellated shafts had the circular lines only on them, the long key-ways being quite sufficient to define the behavior in the other direction.

Voice From the Past

Editorial Prediction of Stability a Decade Ago Borne Out by Present Day Facts

WHAT the Editor of the *Motor Vehicle Review* (now THE AUTOMOBILE), said, under date of November 7, 1899, about the commercial automobile situation, sounds a little quaint, but the wisdom of the ideas conveyed is sound. As a reminder of the stability of the commercial side of the automobile business it may not be out of place to quote just one of the editorials of that "remote" period:

The Demand for Tools

"In these days of increasing activity in the building of machine tools it is more than a passing sign of the times that large demands are made on the constructors by the motor vehicle industry. It is a further indication of the soundness of the industry and the future of its good that these demands are accompanied with financial terms that are entirely satisfactory to the seller. Instead of asking for long time for payment, the reports come from the machine toolmakers that motor vehicle plants are being equipped by them on a basis that is practically cash, and that indicates the healthy condition of the automobile industry.

"This is a matter for congratulation, inasmuch that a plant fitted out under these terms is in a position to conduct its business on lines that mean greater profit on the one hand and reduced cost on the other. These items will mean much to the industry in the coming two years, as in that time the heavy experimental expenses can be provided for, the cost of future depreciation can be looked after and the prices scaled without a diminution of profit-earning capacity.

"As matters now stand the makers of horseless vehicles cannot take care of any boom should such an undesirable condition come about, and the prices current, selling, are within reason, all things considered. On the other hand, the purchaser of to-day will more than profit by any extra price that he may pay over that to come. He will have received the value of advertising, that, while it is incalculable, is admittedly great, and in that time he will have also earned a large share of the bonus paid, in his wisdom, by the decreased cost of operation from horse-drawn vehicles and the increased service secured.

"A merchant who to-day is using two or more horse-drawn vehicles in his business is open to the criticism that he is non-progressive and that he does not understand the art of publicity when that price is only from 20 to 25 per cent. more than he 'feels' he ought to pay."

The "Red-Head spark plug

The Valveless-Motor Situation in Europe

There are now some two or three firms on the continent experimenting with the valveless motor, and while their official statements tend to express their entire satisfaction regarding the new system, there cannot be seen a reason why the "Silent Knight" idea should not find more general introduction in Europe. Nor is it clear why one of these firms that for some years has given the valveless engine its serious attention has not gone to its general installation on all its products.

One of the reasons for this phenomenon is that the makers are not feeling any too sure about the automobiles furnished with valveless engines. A story is told that some years ago when a valveless car entered an important German race it went to the finish, among the leaders, too, but its driver noticed clearly that the suction of the motor was nothing like satisfactory at the high speed necessitated by the conditions. The explanation is that the slide valves, being located inside the cylinders, could not be cooled sufficiently, and consequently expanded to such a degree as to offer a considerable handicap to the gases being admitted and exhausted. In order to overcome this difficulty the automobile firm that built the car in question is now at the point of introducing the thermo-syphon system of cooling into its valveless engines.

The second reason is plain enough to constitute a salesman's "talking point" against valveless motors. A poppet valve may be used, ground, reused, etc., and when it has served its time it is thrown away and replaced by another valve of its kind, which means but a small expense. The same applies to the case of a valve being broken. Slide valves present quite a different perspective, as their manufacture is connected with greater expense, and if by some circumstance or other the valve loses its serviceability, it has to be replaced by a new and costly part. To the automobile buyer in general the valveless motor offers hardly an attraction except silence, which, however, may be reached on other engines as well, if they are given sufficient care, viz., as much care as a valveless motor, if it is to be kept in good order.

Just a Sidelight

When the Parish Lantern Goes Out, and Other Possibilities

NIGHT riding, when the moon is shining and the whirr of the motor is in unison with the co-relating conditions, as a long hard macadam road, a sweet-running automobile, the scent of wild flowers, the twinkling of vagrant stars and the song of the whippoorwill, interrupted, perchance, by sweet communion—what of the lighting facilities; who cares a hang?

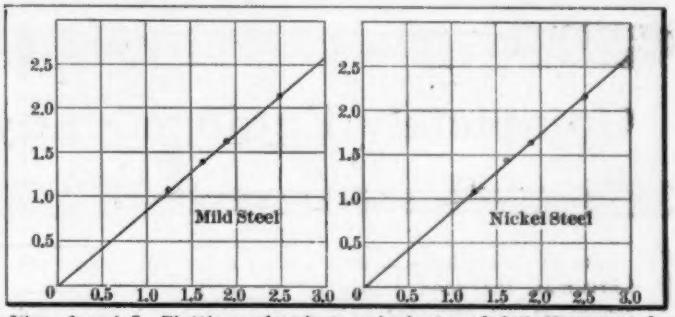
The Comet spark plug

Just another decade of reeling miles; over the crest of a pleasant hill, deep down into a valley, skirting along the sandy boundary of an estuary, and, with a puff of wind, comes the call of a lone gull, another blast and driving rain; the night falls heavily about the now awakened automobilist and his precious freight; blackness gurgles out of the long neck of the bottle of the most impenetrable ink that old night keeps on the weather shelf for just such special occasions. What of the lighting facilities now?

The wise old owl in the crotch of a veteran apple tree by the roadside; he can tell the story; ask him.

Thoughtless man, imitating the darkey who saves up what he is going to get, lands in the pocket of despair, and, consider the picture, what a hiding place; what a swoop; how far it is from the happy condition of but a brief moment; such is life for the man who thinks that the moon cannot be sniffed out; the ink bottle cannot be tipped over; the deluge is not strong enough to burst its binding chains, and more besides, how could Nature be so cruel to such a happy combination?

But Nature is a small boy yet; not out of school; knickerbockers only down to knees scarcely keeping the "blast" from pinkskinned muscular growths. A mere matter of 25,000,000 years, and that Nature is still a rogue is one of the points that the sober-minded automobilist keeps before his discriminating eye.



Figs. 6 and 7—Plottings showing equivalent and full diameters for castellated shafts made of mild steel and nickel steel

In Time of Peace Prepare for War

What a trite saying; how well it works when the war of the elements must be combatted. What a long trek; the migration of artificial lighting, dating from the pine knot, followed by the tallow dip, passing the sperm candle, waylaying kerosene, a brief introduction to electric lighting, the coming of acetylene and the re-entering of the electric light. Who will tell of the victor; who cares; good lighting, utilizing the facilities of the time; letting the future take care of the future and the present rest in the safety of tried-out mechanisms; it is the only way.

Of the tried-out methods let us mention the old reliable kerosene lamp; the lamp that is made so that it will not jar apart, blow out or plug up. Passing on to acetylene; it is a big candle power; a pure stream of light, dense and firm and piercing, but it must be maintained; it is not a light to be left in the keeping of the man who would fail in his duty were he entrusted with the keeping of a lighthouse on a rocky New England shore.

Passing on to the electric light; remembering that it is now the standard of every community for general illuminating purposes, it remains to observe that it is also regarded with favor by those who have been favored by its presence on automobiles.

A Pair of Plugs

The Red Head and the Comet Are Good Examples of High-Grade Work

THE Comet plug belongs to the mica variety and is composed of two parts only, viz., the core and the body. In order to obviate cone or other internal washers the core is made integral with the locking or packing nut. The core pins are wound with sheet mica and reinforced with an extra winding on the engine end. By this means it stands to reason that the current must either travel with the wrapping or to take the path of least resistance, which is undoubtedly the firing points.

In the case of the Red Head plug, which belongs to the porcelain variety, another type of manufacture is used. The different parts of the plug can be taken apart for cleaning and renewal purposes. These consist of the body proper, porcelain, electrode, washers and nuts.

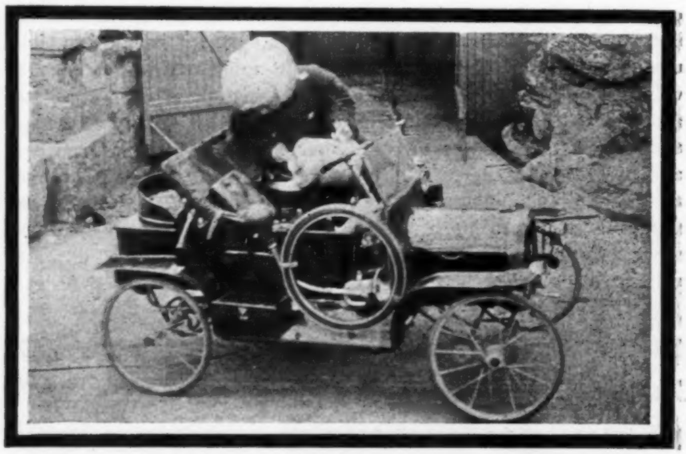
The metal electrode on which there is a boss fits inside a bell formed by the porcelain and is held in compression by a split washer and a nut. The part thus formed by assembly is held in the main metal body of the plug by a brass nut, the base of the porcelain forming a joint with a copper washer.

Completely Equipped Toy Automobile

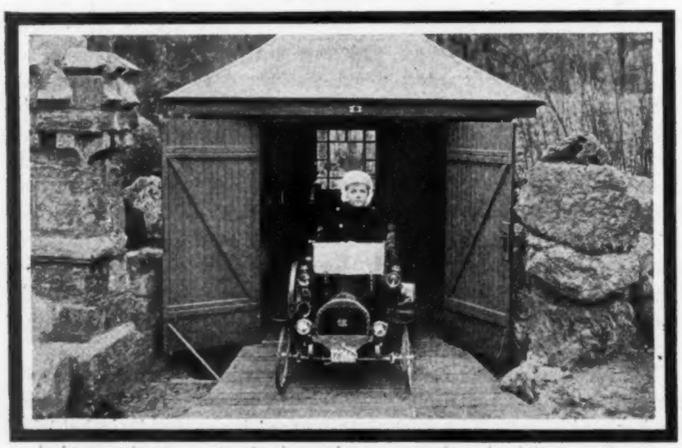
HOW A FOND FATHER GRATIFIED THE WISHES OF HIS SON, WHO WANTED A "REAL" MOTOR CAR

IN order to satisfy his son, who wanted a real automobile for Christmas, the fond father set to work and ordered a replica of his own car. Of course the boy said he did not want a clumsy affair that he could not run himself. The accompanying illustrations show how his desires were satisfied and how near to the real thing the small car resembled the large one. The wheelbase was 48 inches, and for lightness wire wheels of 14-inch diameter, rubber-tired, were used. The power was transmitted to a direct shaft by foot pressure, and the brakebands on the rear axle were operated by a lever conveniently situated at the driver's right hand. The throttle control was fitted to the wheel. The equipment of the car was elaborate and consisted of a full set of tools, horn, two electric headlights, two electric side lights and one tail lamp, operated by push-button from the seat, and the current was furnished by storage battery. In case of emergency a spare tire with dust-proof casing was fitted as well as non-skid chains to the rear wheels. Weather protection for one so young comprised folding windshield and cape top with slip cover. In order to legally operate the car on the highway, license No. 12,314, Mass., was taken out, and to warn the operator of the speed of the car a speedometer and clock were fitted to the dash. To show the care exercised in making this gift a liability insurance policy was included.

Of course, to make everything complete, a garage was built and equipped with the latest tools for making repairs. The age of the lucky possessor of the car illustrated, one John Clark Hopewell, is three years and eleven months, and he lives with his father, Mr. Frank Hopewell, at Newton, Mass.



"Hold on! Forgot to put in my gas. Mustn't overlook that"



"Open the garage door, and away for a spin on the boulevard!"

Auto in Distant Lands

Facts Gathered From Reports of Consuls in Foreign Countries

THERE were imported into Brazil during the year 1910 38,823 automobiles as compared with 22,002 in the previous year.

The postoffice departments of numerous foreign countries are waking up to the use of the automobile for the purpose of carrying the mails. The latest Government to adopt this modern means of carriage is Russia, the Moscow postoffice having made a contract for placing in commission French and German-made automobiles for carrying all mail between the railway stations and branch offices from the hour of 6.30 in the morning till eleven o'clock at night. The contract stipulates that twenty-five automobiles and two reserve motors must be held in readiness at all times. The automobiles are all of 20-horsepower, and of French origin. There are twenty-three motors with a carrying capacity of 2,160 pounds each; and two platform trucks, each capable of carrying 6,480 pounds. The expense of operating each car, including the chauffeur's wage is $3,708, making a total of $92,700 for the twenty-five machines. Since the introduction of the automobile mail service, the postoffice department of Moscow has retired 104 of its original 252 horses and a further reduction will very soon follow with the addition of fifteen more automobiles. The Government also has in mind the installment of a few cars having a capacity of 10,800 pounds.

Scotland has set her face in the direction of automobiles carrying the mails, a nightly motor car service having been established between Glasgow and Edinburgh, with another now being inaugurated between Glasgow and Greenock. A 16-horsepower machine will be used in the latter service, the object being a double journey during each night. The machines are English made.

Batavia, Java, by reason of the enterprise of townsmen has come into possession of four taxicabs which are plied regularly on the streets for public accommodation. The demand for such automobiles seems to be increasing. A tariff of thirty cents is charged for two passengers for the first 900 meters (2,953 feet), and four cents for each additional 300 meters (984 feet). One cent per minute is charged while the car is kept waiting.

Motor cars and cycles to the value of $273,958 were imported into the Straits Settlements during the quarter ended September 30, 1910, this being an increase of $175,603 over the previous quarter.

London has 37,851 motor cars, 12,613 motor-cycles and 2,257 heavy vehicles, which makes a total of 52,721 horseless vehicles of all types. The largest number of horseless vehicles found in any single county in Great Britain, is 8,035, in Middlesex; Kent has 5,775. Birmingham stands first among the provincial towns, having 5,527 automobiles and cycles; then comes Manchester with 3,677; Liverpool with 3,447; Glasgow with 2,154; Edinburgh with 1,830; Dublin with 1,257: and Belfast with 1,006.

cars and cycles. The total number of horseless vehicles in the United Kingdom is 218,680, showing an increase of 36,925 vehicles since 1909. The English and Welsh counties show a total of 141,009, including 84,077 automobiles; in the English and Welsh boroughs there are 52,963 vehicles, including 26,816 automobiles; Ireland has 8,739 horseless vehicles, of which 4,682 are automobiles; while in Scotland there are 15,969 vehicles, 9,355 of these being automobiles.

During the first nine months of the year 1910 automobiles to the value of $310,146 were imported into South Africa, through Port Natal.

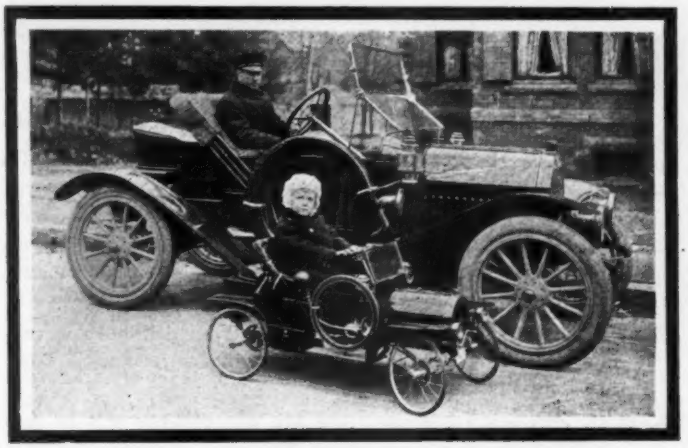
Automobiles have taken the fancy of the Malay States, the increase in the importation of machines and accessories for the first six months of 1910 having exceeded the whole importation of the year 1909. A great number of the cars are English made.

Singapore is getting into line in the matter of automobiles, the number of machines imported increasing rapidly. The steamer *Suruga*, which recently arrived from New York in Singapore, as well as the *Benerty* and the *Kagu Maru* from London, each carried a generous cargo of automobiles intended to supply the trade in Singapore and the neighboring ports. The consignment included many touring cars and roadsters. The growing trade in the matter of automobiles does not seem to coincide with the reports of commercial depression in this

"Looks like rain. Nothing like getting in out of the wet"

section of the Orient. The people of Singapore particularly seem to have been seized with a mania to possess and drive motor cars. One reason for the great boom in automobiles is the increase in the plantation rubber industry and the opening up of new estates in the back country. The year of 1910 showed a marked increase in the imports of machines, the first nine months showing $274,922 worth of machines, while during the same period in 1909 but $98,700 worth of automobiles were imported. Nearly everybody who can afford it strives to possess a machine, and the consequence is that nearly every steamer arriving from London and New York carries consignments of at least one touring car.

Germany's financially able people are limited in number, as compared with the people of the United States. Therefore, it is the tendency of the conservative classes in Germany to look upon the automobile more in the light of a luxury than a necessity. For example, physicians do not resort to the machine here to the extent that they do in the States. The German manufacturer has not been slow in absorbing all of the patronage that came his way, so far as the local market is concerned. It is in a business sense rather than as a vehicle for pleasure that many Germans regard the automobile. To this end, machines of a cheap grade have the first call. One can purchase a German-made, four-cylinder machine of the phaeton type, of from 12 to 14 horsepower, seating two persons, for $900; while a car with four seats may be bought for $935. The price does not in-



"Guess I'll slow up a little. The cop might pull me in"

clude lamps, glass front piece, top cover and small accessories. The upholstering is in imitation leather. For the sum of $625 a two-cylinder car of 6 to 7 horsepower can be bought; while $400 will buy a one-cylinder car of 5 to 6 horsepower. Gasoline (called benzine here), and the carbureter are used in nearly all of the cars in Germany. Steam and electric automobiles are almost an unknown quantity. Sometimes an American-made electric runabout is seen in Berlin and in other large cities of Germany. Especially is this sort of vehicle adapted for the use of women, it being considered here a safe vehicle, while it also is stylish, and it serves many a woman on her shopping tour. In establishing an automobile business here it is imperative that there should be showrooms amply stocked with accessories and parts. All of the catalogues in the world will not sell automobiles in Germany, if unaccompanied by the machine itself. No more will photographic representations of machines serve to sell goods. Moreover, it is necessary, as is the case in so many other continental European countries that the selling agent should speak the language of the Fatherland fluently. A permanent exhibition, with capable persons to demonstrate the machines intelligently and to the absolute satisfaction of the intending purchaser are the only methods by which foreign-made machines can be sold in this country. When catalogues are prepared, stress should be laid upon the economies that the purchaser would come in for, by substituting an American machine for one made in Germany. The testimony of reliable persons who have used the particular car in question is valuable, but it should be printed in German. Technicalities are to be avoided, as the average German is not particularly up in this sort of automobile knowledge. Say if the machine can climb hills; if it runs smoothly; if it is comfortable to ride in; if it is economic in the use of fuel; and if in the careful handling of the machine, repairs will be few in number and extent.

"I'm getting hungry. Guess I'll hurry back for lunch"

It Stands to Reason That a Man's Own Judgment Should Not Be Supplanted by the Ideas as Advanced by the Seller's Representative. The Law Says: "The Purchaser Shall Look Out for Himself." In Other Words: "Let the Purchaser Beware."

That progress is being made in the building of automobiles; to purchase an advanced type of automobile requires that the purchaser have advanced ideas.

That advanced ideas cannot be acquired from polluted sources; the intending purchaser must get his information from reliable sources.

That all channels of information are not reliable will be testified to by every purchaser who was deceived, not only by salesmen who failed to tell the truth, but by periodicals that are crammed to the brim with irresponsible publicity.

That it is necessary for the purchasing public to support honest periodicals; it costs money to build them; the other kind do not have to go far in quest of support.

That the makers of good automobiles do not have to club an editor to get him to publish the facts; the wielder of a club is acting suspiciously.

That the editor who does not know when he is being clubbed is so lacking in knowledge of his requirement that he is incapable of building a good magazine.

That there is a great difference between demanding the facts and "muck-raking"; there is nothing of value in a magazine that is employing a battery of "pitchforks" in the process of turning over the muck.

That the truth is too mighty to be trifled with; it shines with a luster that is not to be supplanted by "paste."

That a liberal construction of a firm resolve to be right up to the limit of human endeavor has no opposition from men who do business on an honest basis—most men do business on a basis of equity.

That purchasers (a large number of them) fool themselves; they think that they know what they want—do they?

That it is no fault of the seller if the purchaser takes title to a device that will not serve for his real purpose if that purpose is concealed during negotiation.

That a large number of purchases are made under implied conditions; in other words, it is implied that things are so and so, but they may not be so and so—they may be otherwise.

That the English language is so complex that it is easy to be misunderstood; the crooked salesman takes advantage of this fact.

That it is good policy to have the understanding in plain English; if both sides are honest it is a source of protection to both sides to use language that cannot be misconstrued.

That it is better to purchase a good automobile than it is to pay good money for a 200-word guarantee; a 4-wheeled guarantee is a poor hill-climber.

That a guarantee is all right if it is accompanied by an automobile that will do the purchaser's work.

That the man who says that he is delivering more automobile per dollar than his neighbor, should be willing to disclose enough of the secret to satisfy the purchaser that he knows what he is talking about.

That the seller who runs down his neighbor's make of automobile should know how that automobile is made.

That some salesmen are as tame as house-cats; they do not seem to know what they are purring about.

That a tame cat and a sleepy purchaser makes a dissatisfied user.

That every owner of an automobile owes it to himself to keep posted on the doings in the automobile business; take a few moments each week reading up on the various phases of the trade as they appear in reliable magazines.

That the editor who adheres to the truth is likely to make a few enemies among burglars, but he cannot be sure of support sufficient to maintain him from those who prefer truth.

That users of automobiles are to blame if the literature of the day is tainted; editors invariably hear from advertisers if they are offended, but patrons maintain silence and the testimony, as it comes in the mail, is one-sided.

Mounting Ball Bearings

Mounting Directions for Annular Type Ball Bearings as Issued by Hess-Bright Manufacturing Company

STABILITY of mounting of ball bearings must be looked after if the life of the bearings and the service of the automobile is to be on a fitting basis. The following are the recommendations of one of the makers of experience:

Reasons for Certain Mounting Directions—The inner race should be a permanently tight fit on the shaft; otherwise the continued action of the load, concentrated on the short shaft length corresponding to the bearing width, will pein down the shaft; in time, and particularly with soft shaft material or ordinary lathe or file polish fits, this will bring about a serious cutting of the shaft.

A reliance on a drive fit alone is not sufficient, as that may be destroyed by an occasional dismounting or by the action referred to. Binding the inner race endwise between a substantial shoulder and well-set-up nut creates a frictional grip on the shoulder and nut faces that prevents the transfer to the shaft surface of the destructive influences cited: this binding forms a very efficient substitute for bearing seat length. Neglect of this direction results more generally in damage to the shaft, but occasionally also to the bearing. When structural reasons make it advisable to have the inner race a slip fit on the shaft instead of a drive, the endwise binding must on no account be omitted.

The outer race should be a sucking fit in the housing. If this race is fixed against rotation the load will always come on the same place; if it can take up a different position occasionally, new sections will come under the influence of the load. A sucking fit of the race will be accompanied by a slow intermittent creep under the slight vibrations of the load. In order not to prevent this creep, the sides of this race should never be absolutely clamped, even when the race is held between shoulders to prevent end movement of a shaft; a slight clearance, 1-64 of an inch, or as much as is admissible, should always be left on each side.

Enclosures should be such as to retain lubricant and exclude dust and moisture.

Lubricants—These may range from the lightest of spindle oils at high speeds to fairly heavy greases at low speeds. The less frequent the attention given, the heavier should be the lubricant. An excess of lubricant, enough to force out at the closures,

should be employed whenever the entrance of grit or moisture is to be feared. Lubricants containing or developing acid must be avoided, as must those that become rancid.

Interchangeability and Accuracy—All "HB" (American) and "DWF" (German and French) radial bearings are accurate as to the bore within 0.0002 inch plus and 0.0004 inch minus. Outside diameter from 0 to 0.0006 inch to 0.0012 inch minus. As to the width within 0.002 inch minus.

These accuracies are necessary for economical shopwork in mounting the bearings. Greater limits of tolerance than these will either result in inferior work or the necessity of costly special fitting of each piece to its bearing. The extra price that these close HB limits necessitate is more than made up in manufacturing economy and the certainty of replacement without dismantling parts for refitting.

Running Fits—A ball bearing, like a plain bearing, must have a running clearance; but in the well-made ball bearing this clearance is much smaller than is a plain bearing; in all new bearings this freedom (radial freedom) is less than 0.001 inch. The radial freedom is accompanied by an endwise (axial) freedom of one race with reference to the other; this will vary with the ball diameter and ranges from 0.0006 inch to 0.006 inch for new bearings.

Old Bearings and Wear—A properly made and not overloaded bearing will not show wear in the ordinary sense of plain bearings, i. e., a reduction of the diameter and increase in bore. That and reduction in ball diameter can occur only when abrasive grit is admitted to the bearing. Grit will quickly grind down a bearing at a rate depending only upon the sharpness of the grit and the amount of time the bearing is exposed to it.

An overloaded bearing will not be worn, but the surfaces of the balls and races will be destroyed; that will show first by minute pin holes and later by flaking. A large ball will take more than its share of the load and may therefore bring about all the appearances of an overloaded bearing; to avoid this, no ball must vary by more than 0.0001 inch from its fellows in the same bearing. It is on this account that bearings must never be dismembered, as otherwise balls are likely to be mixed; neither must repairs be made by adding balls to a set. Such repairs should be undertaken only at maker's plant where full sets of even size balls are available.

Rust is absolutely destructive to a ball bearing. It is very readily recognized; even in a bearing which has been cleaned so that no red rust is to be seen, the presence of more or less pronounced pits and excoriations, not only on the race surfaces, but also on the other parts of the bearings, is clear evidence. These pits are very distinct in appearance from those due to overload; aside from that, overload pits are necessarily confined to the balls and the ball tracks.

Loose Bearings—A very considerable rocking freedom of the one race with reference to the other as the result of grit cutting will do no harm. An amount of rocking that at first seems alarming in the individual bearing may be due to a radial clearance of but few thousandths of an inch. It is the radial clearance which determines the further usefulness of the bearing; as two bearings are always used at some distance apart in the support of a shaft or wheel, these latter can not rock by more than the radial freedom of the bearings, not by their angular freedom. To determine its true radial freedom, the bearing must be so held that the races are moved only crosswise without any lengthwise or tilting motion.

Bearing Repair—Bearings in which the balls or ball tracks are pitted or roughed up from rust, acid or overload can not be repaired. Bearings ground down by grit so as to be loose can be put in good order by the introduction of a new set of larger balls. The same amount of care must be exercised to have all these balls within 0.0001 inch as with a new bearing; it will not do to put in a few new balls only, nor will it do to accept a dealer's belief that the balls in his bin are within the necessary limit. Unless this grinding action has lasted too long, it will be practicable to restore the bearing to somewhere near its original condition; even though such refilled bearing should be somewhat looser than a new one that does not justify the expense of a replacement.

Design Features of Freight Automobiles

Illustrating Some of the Structural Details of the Freight Automobiles That Are Being Shown in the Coliseum and First Regiment Armory at Chicago

SPECTATORS at the second section of the Chicago Show are made up for the most part of merchants and others who are interested in the transportation of goods, and it would appear from their demeanor that they have gotten beyond the point where the color of the paint or general appearance of a freight automobile would be likely to interfere with their judgment. It is rapidly being learned that accessibility is an important consideration; moreover, the point has been established that a truck should be capable of carrying its rated load over the average roads without showing distress, and it is quite apparent that there is no tendency on the part of those who propose to use freight automobiles to complain about massiveness of construction, provided only that the speed at which the cars are required to travel is maintained at a sufficiently low point to save the structure from the shock and jar that must be attributed to speed only. It is amazing the extent to which wagon-masters are discussing the technique of freight automobile transportation. They seem to appreciate the fact that the life of a car is inversely proportional to the square of the velocity, as a general proposition, believing also that the weight merely affects the life in direct proportion.

It requires no great amount of acumen to arrive at the conclusion that the wear and tear on a mechanism is mostly confined to its joints and bearings. That the joints will survive because they are massive is not believed unless the platform on which the machinery is placed is so stout that it will

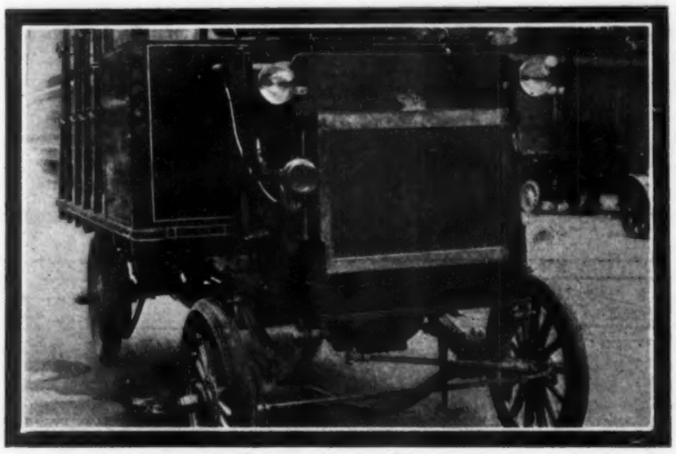


Fig. 1—Looking at the front of the Brodesser truck, showing the flexible suspension of the radiator

maintain the alignment of the parts under working conditions. All automobiles look substantial enough when they are resting upon the floor doing nothing, but the question is will they retain their substantial characteristics when they are bouncing along a rough road under more or less overloaded conditions. The best way to be sure that the surface will be in keeping with the requirement from the low maintenance point of view is to select the character of trucks that are well made from suitably selected grades of material, utilizing a chassis construction that is a bridge of no mean strength, but even under the most favorable conditions it still remains to so mount the machinery on its platform that it will not have to distort in response to road inequalities.

Provision Is Being Made for Adequate Lubrication

The bearings throughout the various trucks, taking them as a whole, are relatively large and so mounted as to be protected from the silt of the road, but every engineer knows that a bearing adds nothing of value if it is over-big, and success depends upon lubrication more than from any other point of view. The workmen who have charge of freight automobiles are no doubt of average intelligence, but it cannot be expected that all the cardinal virtues are to be had for $15 per week, and experience is the teacher which says quite a number of these virtues are missing in the makeup of the average driver of freight automobiles. It is not to be expected that a driver will get up at 4 o'clock in the morning and after partaking of a light repast hie away to the garage and busy himself hunting for places to put lubricating oil, if, after a reasonable amount of research on his part, he mounts to the conclusion that the designer was a most ingenious chap with queer ideas in relation to questions of lubrication.

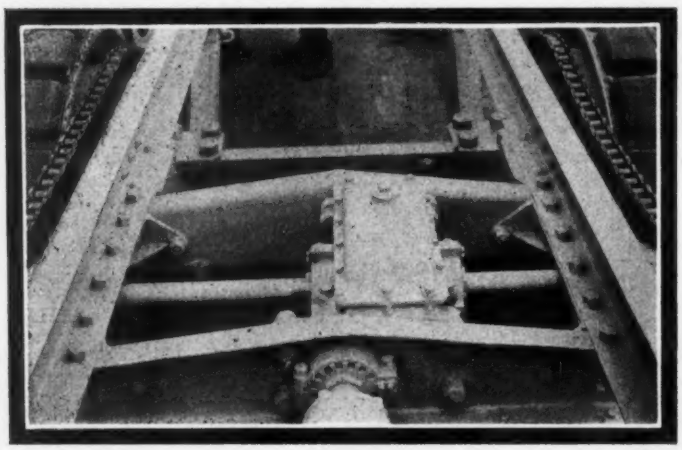


Fig. 2—Rear end of Hewitt chassis, showing suspension of jackshaft, side chains, substantial chassis construction, and considerable overhang

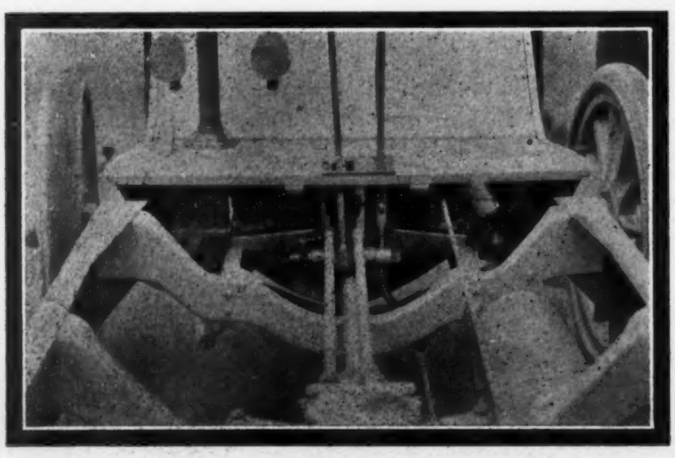


Fig. 3—Looking at the Adams chassis from the rear, showing the details of design, left hand control, and simplicity of the arrangement of the mechanisms

It is a source of much regret that it was impossible to get a considerable number of photographs of the details of the freight automobiles as they were moved into the Coliseum, but the insurance regulations do not permit of flash-light work there, and counting twenty-four hours as the time consumed in getting the photographs to New York and through the engraving process, it was necessary to do the photographing as the cars moved in, for the most part, but fortunately by a display of energy on the part of the photographers, quite a number of details were taken, and it is to be hoped that they will suffice to bring out the point that the 1911 freight automobiles of American makes are vying with each other on a basis of equality, and are so contrived that they will conform to the requirement under the most exacting conditions of service.

Referring to Fig. 1 of the Brodesser truck, attention is called to the spring suspension of the radiator as it rests in front of the dashboard, and the use of electric lights. Fig. 2 presents the Hewitt truck at a point back of the motor indicating a very substantial chassis frame construction, and a mounting of the jackshaft unit that is in keeping with the main scheme, and attention is called to the bearing in the crossbar in front of

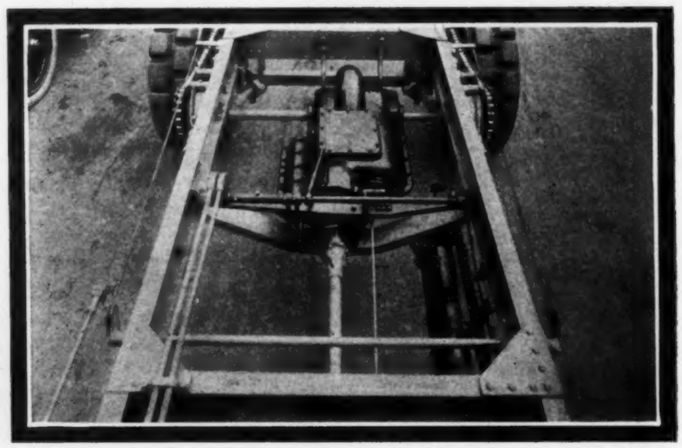


Fig. 4—Looking down upon the Knox chassis, showing the location of the transmission gear, side chain drive, double biscuit tire system, and simplicity of the arrangements

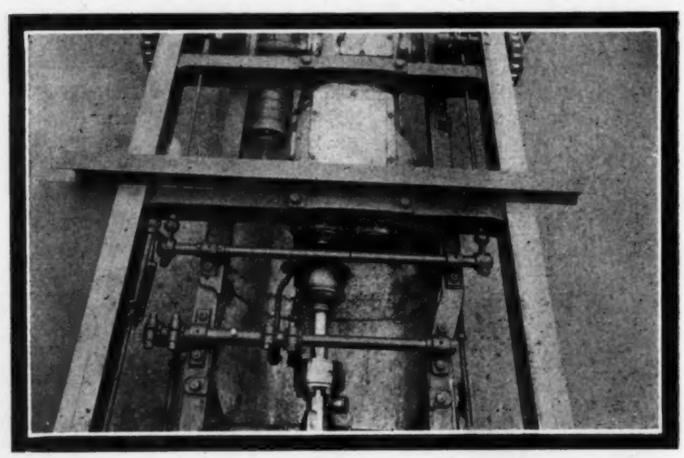


Fig. 5—How the Mack truck looks from the dashboard back, with its substantial chassis construction, unit transmission gear, and side chain drive

the differential, with means for adjustment, and with details so worked out that the process of assembling and taking down is much simplified. Fig. 3 is of the Adams truck, and a newcomer by the way, showing the motor mounted on a sub-frame and well-contrived crossbars, with the emergency brakes and sliding gear levers coming up in the middle of the platform, and the steering wheel placed on the left hand side. Fig. 4 shows some nice chassis details of a Knox truck, with a long platform made of channel section steel, and crossbars at equi-

distant points, thus assuring strength. The control mechanisms are straight line and of substantial construction. Fig. 5 shows the details of the nesting of the control mechanisms and the location of the transmission gear, which is a unit with the differential and jackshaft in the Mack truck.

Fig. 6 is a front end view of the Mais truck, showing the motor over the front axle, and the flexible mounting of the radiator, also a buffer bar across the front. The front end of the Sampson truck is shown in Fig. 7, indicating a flexible

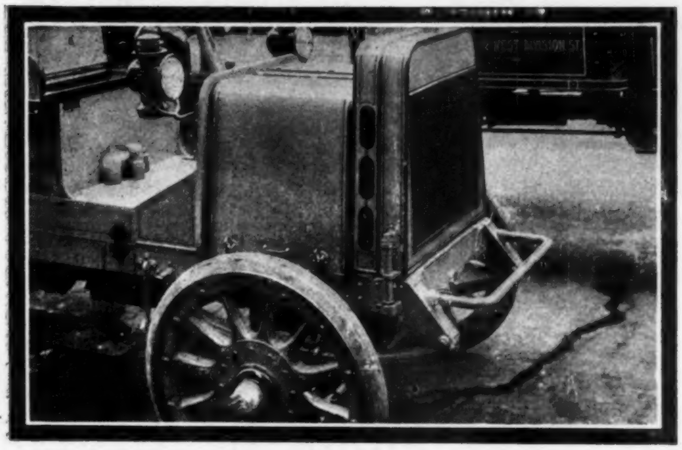


Fig. 6—The Mais commercial, showing the front end, and the flexible method of attaching the radiator

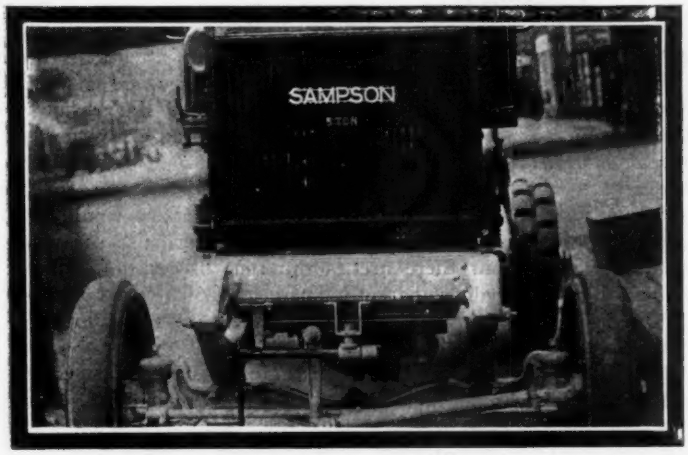


Fig. 7—Front end of the Sampson truck, presenting a flexibly mounted radiator, substantial I-section front axle, and a steering mechanism that is noted for its strength

mounting of the radiator, and a substantial form of I-section front axle, excellence of the cross rod, and parallelism of the drag-rod with a straight arm steering member reaching down from a firm support on the under side of the chassis frame. The rear wheels are fitted with double biscuit tires, and the driver holds a position on the right hand side of the car. Fig. 8 is another view of the Sampson truck, and attention is called to the location of the magneto on a finished spot over the back cross arm of the motor just in front of the flywheel. The Kissel truck is shown in Fig. 9. The jackshaft is presented coming out from the chassis frame with a distance rod between it and the rear axle, thus fixing the centers for the sprocket chain, and in this example the brake-drum is inside of the chassis frame. Fig. 10 shows the front end of the Rovan commercial with a radiator mounted on trunnions, the support of the latter coming directly upon the front springs. The axle of this truck is tubular, and it being of the front-wheel drive type, the axle terminates in a yoke-like construction, and the differential housing amidship is supported by a yoke also. There is a considerable amount of novelty in this construction, and it is one of the features of the Chicago show. Referring to Fig. 11 of the Harder truck, the rear spring equalizer is

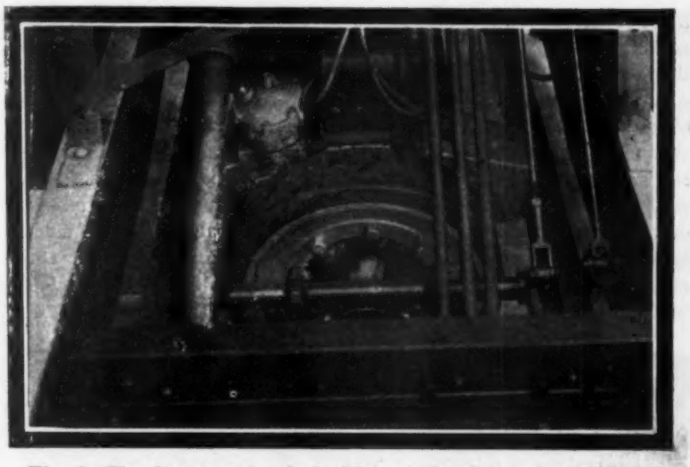


Fig. 8—The Sampson truck, looking at the motor from the rear, showing the magneto on a finished surface just in front of the flywheel

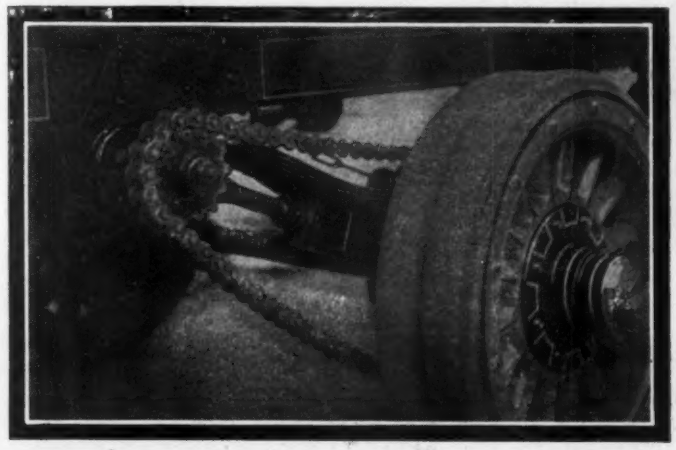


Fig. 9—The Kissel truck, looking at the rear axle and side chain drive, showing a substantial distance rod and strength of the mounting of the jackshaft unit

brought into view, in which it will be observed that the platform remains level when one of the wheels is lifted off the ground, and it is claimed for this construction that it is marvelously flexible, which idea promotes low depreciation. Fig. 12 shows a detail of the spring suspension of a Knox truck and a grease cup is placed to lubricate the wearing surfaces where the masterleaf of the spring bears against its accommodation surface, thus promoting flexibility and preventing noise.

An excellent idea of the scheme of design of the Reliance truck is shown in Fig. 13. Looking at the same at a point in front of the rear axle where the differential shaft extends out from the chassis frame indicating how the brake-drum is fastened onto the jackshaft just inside of the sprocket wheel, and the method of suspension of the shoes, also details of control. A commodious grease cup is screwed into a threaded orifice at the axis of rotation of the jackshaft. There are other nice details but they will be obvious to the interested reader. Referring to Fig. 14 of the Brodesser truck, the motor is shown under the footboard, the driver's seat being elevated so that when the car is making headway in a congested street, the driver can look ahead and judge as to the best way to maneuver out of a difficult situation. The motor is accessible and the radiator is flexibly mounted. Moreover, the front crossbar of the chassis frame extends out to take collision blows, and the lamps in front are so set as to be protected without interfering with the projection of the beam of light so that it will intercept the roadway ahead at a point where it will do the most good. Referring to Fig. 15 of the Knox truck, attention is called to the flat scroll spring which is used as a flexible mounting for the radiator, and the tie-bar across the top of the chassis frame which also serves to shield the radiator. Fig. 16 shows

the shackles of the rear platform springs of a Rapid truck, and the details of the chassis frame at the point of support at the cross member of the platform system. Fig. 17 is a view of a Knox truck showing the jackshaft extending out from the chassis frame and brake shoes on a drum which is placed back of the sprocket, bringing into view the round section distance rod and a turn-buckle in an accessible position which is used to fix the centers between sprockets and maintain alignment of the rear wheels. The fastenings of the brackets to the side-bars are by means of numerous rivets, provision being made for an adequacy of bearing surface by means of wide flanges. Strength is shown at every point.

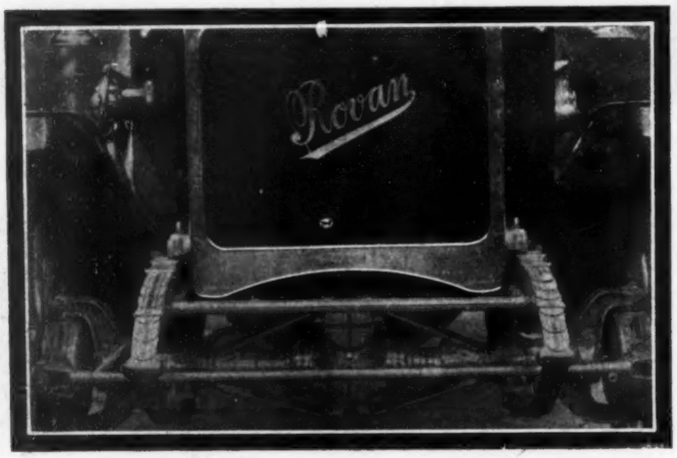


Fig. 10.—Front view of the Rovan commercial, showing the radiator mounted on trunnions and a yoke-like construction of the knuckles and other refinements

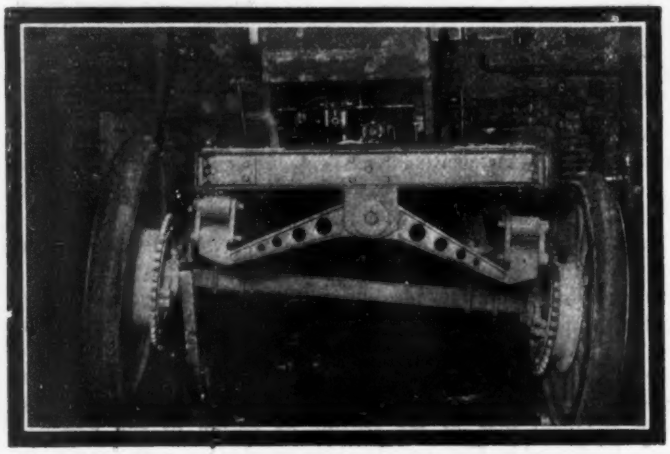


Fig. 11—Rear spring equalizer on the Harder truck, showing a level platform with one wheel out of contact with the ground

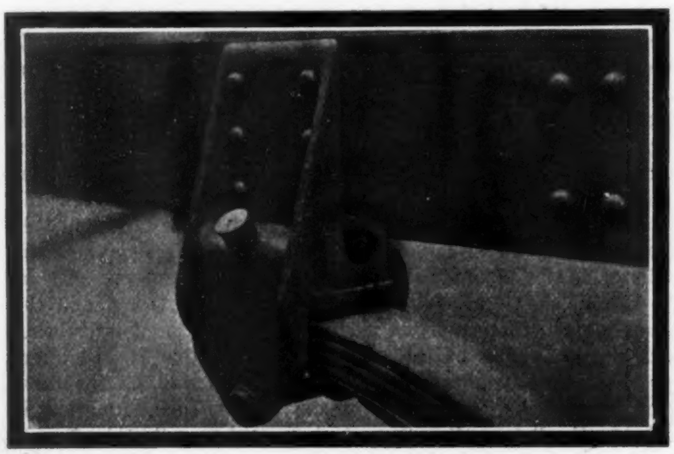


Fig. 12—A detail of the Knox truck, showing the front end anchorage of the rear spring suspension

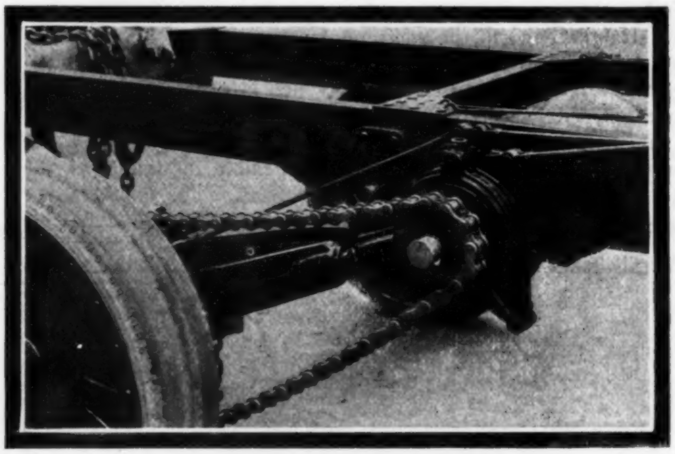


Fig. 13—Looking at the Reliance truck where the differential unit fastens to the chassis frame, presenting a substantial distance rod and other refinements, including brakes on a drum of the differential shaft

The Motor in Australia

SYDNEY, N. S. W., Jan. 9.—Last week attention was drawn to the good market American cars are gaining in Australia, and to further emphasize our remarks, the following is an abstract from one of the leading daily newspapers, in Sydney, N. S. W., *The Daily Telegraph*, dated Dec. 24, 1910:

"Some time ago it was forecasted that Australia would be invaded by American cars, and there is every promise of such proving the case, for there are 45 different makes of Yankee cars now on the Sydney market. There are 66 different makes of English cars, however, and 35 different cars of French manufacture."

Now, this is truly a remarkable feat, for less than two years ago it was almost an impossibility to get any buyer to even think of an American car, and not only that, every agent had his business fully loaded with European cars.

Turning to power wagons, the trade is in the hands of British makers, but who to some extent are very carelessly looking after the business they now have owing to the fact of their not preparing for quick delivery, and although agents in Australia are pushing for supplies, they have to be content with a few wagons now and again.

Many agents in Australia who have just returned from a trip to England say that the British manufacturer seems, on the average, to have little desire for an export trade because there is a good demand in England for his vehicle. This condition of affairs is affording a splendid opening for the foreign manufacturer, and wagons made by such firms as Renault, F. I. A. T., Berna and S. P. A. have now found a market, and now two American makes have just been introduced, viz., Grabowsky and Gramm. Two Grabowskys are now engaged in a passenger and mail service between two country towns in New South Wales, but the Gramm is, at the time of writing, unsold.

The wagon greatest in number is the Albion, made in Scotland, and there are now over 50 of this make in use, and it is a certain fact that if the agents could have been supplied with as many again, they would have all been sold. Other prominent makes are the Leyland, Thornycroft, Commer, Lacre, and Hallford. The trade, as we have already said, is firmly in the hands of the British, and this is due to the fact that every big business in Australia has a London office and business men in-

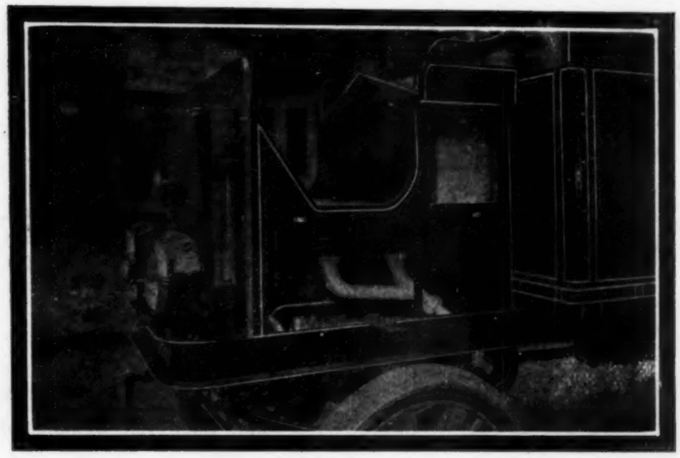


Fig. 14—Depicting accessibility of the motor as it is installed at the front end of the Brodesser truck, also showing the flexible mounting of the radiator and the lighting equipment in a protected position back of the front crossbar

"THE AUTOMOBILE'S" CORRESPONDENT GIVES A RESUME OF THE TRADE THERE AS IT AFFECTS THIS COUNTRY

variably apply to the London office for their advice and their experience.

Those in Australia who are supposed to be an authority on wagons are laboring under a delusion that no American wagon will ever be much good, and we clip the following from *The Sydney Morning Herald,* Dec. 23, 1910, in an article entitled, "The Commercial Motor":

"We know that America is rapidly completing arrangements to place commercial vehicles of proper build and design on the market, and by the end of 1911 some of these will probably be with us in Australia, which will make competition keener than ever. At the same time, although we are quite prepared to admit that there is likely to be a sale for American pleasure cars, we do not think that the American commercial vehicle is likely to oust the best of British manufacture."

Although this is the feeling in Australia at the present time, there is no doubt that the American wagon will have a market after it is once introduced. Although the European wagon has a good market, their makers are ignoring the fact that the small light delivery vehicle is also called for, and in no instance whatever is there a power wagon on the market in Australia to carry a light load of about 500 lbs. The lightest wagon marketed is probably a 9-horsepower Renault to carry one-half a ton, and this is being sold at the enormous price of $2,000.

It must be clearly understood the roads in Australia are, as a rule, very stony, the surface of many roads being nothing better than a lot of loose stones, and on account of this, users do not like the use of pneumatic tires, and any vehicle being fitted with solid tires will have a better chance of business than any pneumatic tired vehicle. Several English manufacturers are fitting some of their vehicles with steel tires, and this class of wagon is being appreciated by merchants, as the question of tires is the only thing that is retarding the advent of wagons.

To give an instance, a large carrying company in Sydney has recently bought several wagons, and a two-ton wagon was used on a road, which is the main outlet of Sydney, to the extent of 90 miles daily, working on an average of 12 hours each day, and after 2,400 miles the dual solid back tires were absolutely chopped to pieces and the cost of replacing amounted to $400.

In the matter of taxicabs Australia seems to have lacked a lot owing to the old-fashioned law, and this more particularly applied to Melbourne, Vic., where the tramway company had an agreement with the Government that no mechanical-driven vehicle could be licensed to apply for hire, but in all the other States the matter had to be considered by the local governments, and under these difficulties the taxi failed to make its appearance until eighteen months ago, and then each State had a local concern of its own which possessed some six 9-horsepower Renault cabs and these numbers were augmented by a few now and again. Three months after their introduction The Australian Motor Co., Ltd., was floated, and that company to-day now own over 100 cabs, and they will in a few months have over 400 Napier cabs in the three principal cities.

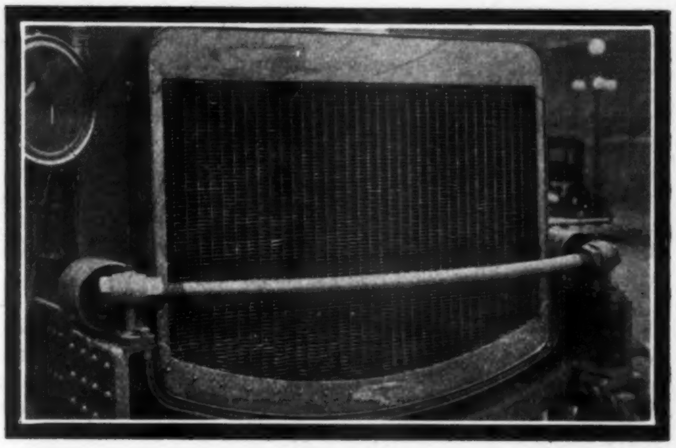


Fig. 15—Looking at the front of a Knox truck, showing the scroll flat spring suspension for the radiator, and a protecting bar across the front

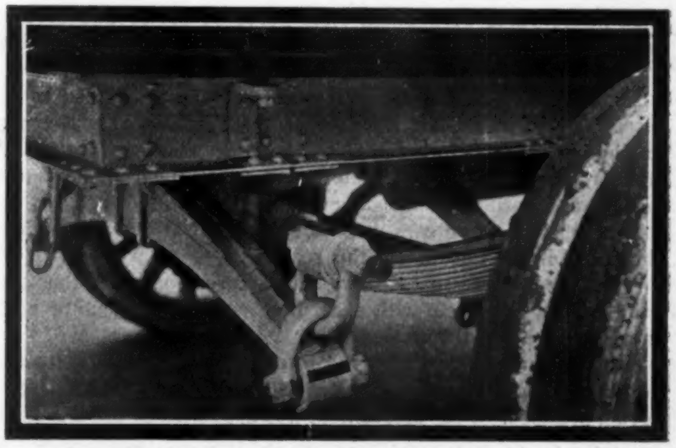


Fig. 16—Presenting the spring shackles of the Rapid truck and showing the platform spring construction

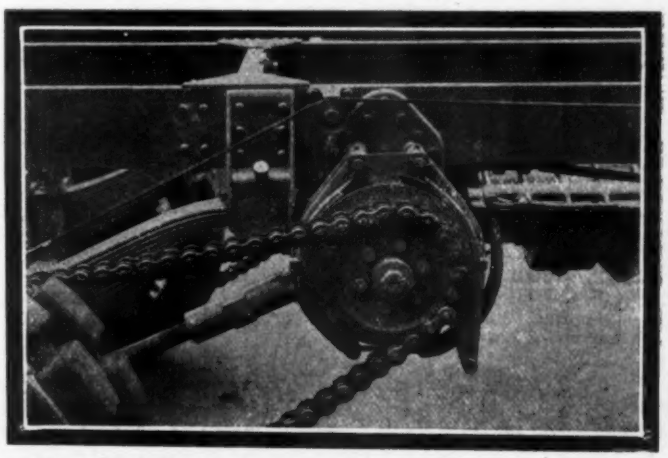


Fig. 17—Looking at a Knox truck at the point of support of the jackshaft, showing brakes on a drum and accessibility of the working parts

Decorations to Be Gorgeous at Brooklyn

BROOKLYN, Feb. 6—Decorating the Twenty-third Regiment Armory for the Brooklyn automobile show, which is to be held under the auspices of the Brooklyn Motor Vehicle Dealers' Association, from February 18 to 25, is well under way. Gangs of craftsmen, under the direction of M. A. Singer, have been working in the building since Wednesday and are rapidly transforming it into a fairyland.

Already the big steel girders of the armory are covered with a canopy of salmon pink and white cloth, which droops gracefully down the side walls. The armory lends itself admirably to decorative purposes and the workmen are having little difficulty installing the scenic effects. Many miles of wiring are being strung through the building. The scheme of decoration necessitates the use of 12,000 electric lights. From the ceiling will hang twenty-four of the most expensive and beautiful crystal candelabras and electroliers that were ever constructed. These will throw a soft light over the entire hall and combined with the several thousand electric bulbs the lighting of the building will be as brilliant as the rays of a sunset in June.

On the main floor, where the latest creations in cars are to be shown, are to be four sections of pillars of colonial design which will extend from the front to the rear of the building. These pillars will divide the car exhibits and also mark the spaces of the exhibitors. The pillars support big beams which run the entire length of the armory, atop of which will be ornate globes filled with artificial flowers from which vari-colored lights will radiate. The car exhibits will be covered with a green carpet and the bare walls will be hidden by burlap of the same color. More than 56,000 yards of bunting, 6,000 yards of burlap and several hundred thousand feet of lumber are to be used in the decorating of the building and in the construction of the booths.

To date there are 50 different makes of cars scheduled to be displayed, but as the list is still open there will be several more exhibitors added before the week is over. The cars are all of standard manufacture and visitors will see in them all the latest designs and fashions that will prevail during the year.

A number of these cars were not exhibited at any automobile show held in the East so far this season..

A number of accessory dealers have secured space and thus the building will be replete with everything pertaining to motor cars as well as the cars themselves.

At a meeting of the Brooklyn Motor Vehicle Dealers' Association held recently a special committee, headed by W. H. Kouwenhovan, president of the association, was appointed to ask Borough President A. E. Steers to officiate at the opening of the show on February 18. Mr. Steers has consented to make the opening address.

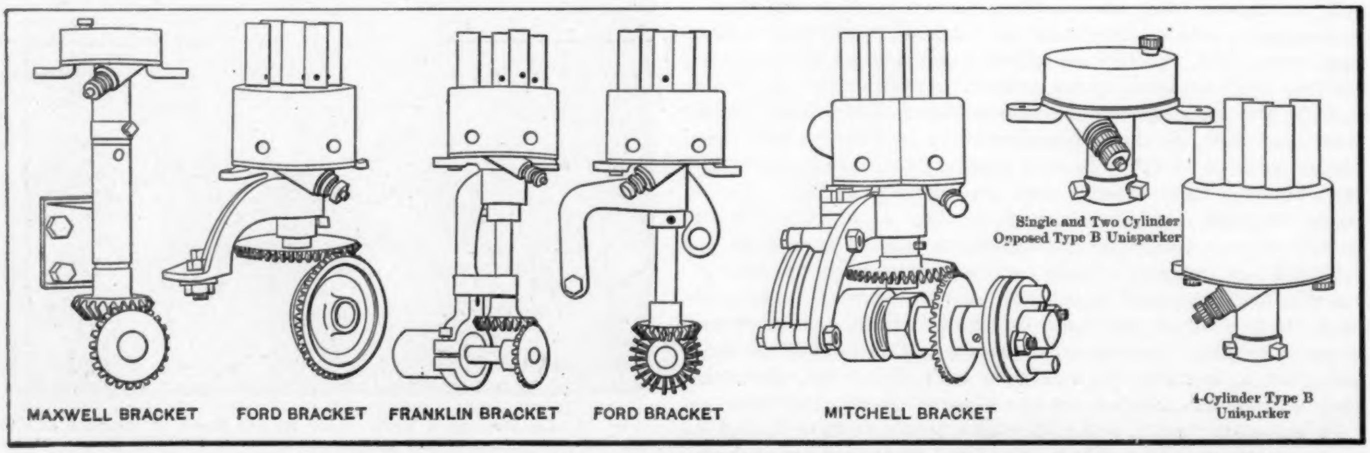
The cars to be displayed include the following: Packard, Peerless, Chadwick, Halladay, Stearns, Mercer, Haynes, Reo, Fiat, Oldsmobile, Herreshoff, Waverley, Marion, Cole "30," Ford, Autocar, Colby, Page-Detroit, Columbia, Maxwell, Locomobile, Knox, Garford, E-M-F, Flanders, Hudson, Chalmers, Winton, Mitchell, Otto, Cadillac, Stevens-Duryea, Stoddard-Dayton, White, Thomas, Croxton, Franklin, Corbin, Pope-Hartford, Lozier, Buick, Premier, Oakland, Overland, Marmon, National, Case, Rainier, Beyster-Detroit, Gramm truck.

Accommodation Brackets for Unisparkers

Quite a number of automobilists who have old models of cars ultimately reach the conclusion that they desire to re-establish the good working qualities of the ignition system, and when they select the Unisparker system, as manufactured by the Atwater Kent Manufacturing Company of Philadelphia, Penn., they are confronted with the usual difficulty, excepting in the cases where preparation has been made in the manufacture of the motor for this system. The F. R. Parker Company of Boston. Mass., distributers in New England of the products of this name, having had to deal with this problem, contrived a set of brackets as here illustrated, for the purpose, and, as will be seen, they are of neat design, simple in construction, and fashioned in view of the particular makes of automobiles in connection with which they are to be used in the application of the Unisparker system of ignition. The makes of automobiles for which brackets are in stock are named in the illustration, and it should prove a convenience to automobilists to be able to thus obtain the right size of bracket for the work, at a reasonable cost, and without delay.

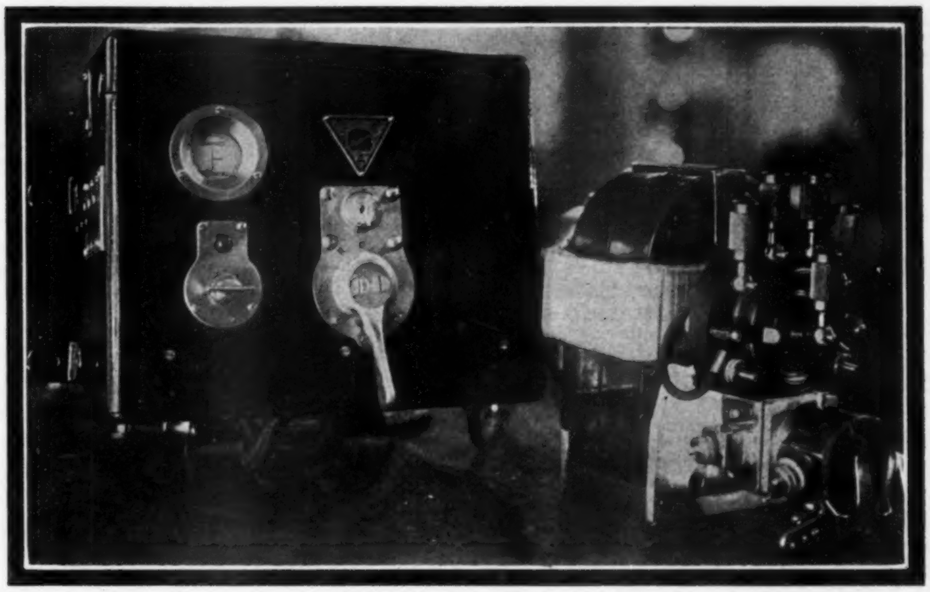
Remy Ignition and Lighting Equipment

The illustration as here afforded is of the new Remy ignition and lighting equipment which is so designed that it will go into the space as ordinarily occupied by a Remy magneto of the type as used for ignition purposes only. As the illustration shows, the new system is in the form of a modification of the magneto as ordinarily employed in ignition work, and the Remy system being of the low tension type, offers an opportunity to so wind the armature that enough current may be taken from it for lighting and ignition purposes without so seriously affecting the electrical relations as would be true of a high tension magneto. The new system is used in conjunction with a battery, which is so connected as to "float" on the line and in this way it is possible to take advantage of the battery and its high current capacity sufficiently to prevent the I^2R factor of the armature from causing the magnetic field to shift so badly as to interfere with the sparking angle during



Illustrating the various sizes of brackets that may be used in the fitting of unisparkers to the several given makes of motors

the operation of the lights. When the car is running at a low speed, if the motor is throttled down also, the arrangement is such that the work falls on the battery. The designer points out that the noted feature of this system is represented in the means used to operate the battery through the coil box and the timing device, protecting the magneto from the battery current. An automatic device is used to throw the battery into engagement if the speed of the magneto rotor falls below the point at which the voltage of the battery exceeds that of the rotor windings, and when the potential difference across the terminals of the rotor is in excess of the potential difference of the battery the automatic device throws the battery back to the floating position. As it seems, there is no time when the magneto will have to furnish current to the lights and the ignition equipment unaided by the battery, so that the question of how the magneto would have to perform unaided by the battery does not have to be discussed. Whether or not the armature delivers a direct current is not clear—presumably it does; in this case the collector rings of the ordinary magneto would have to be displaced by a conventional type of commutator. The equipment is furnished complete, including instruments for determining when to charge the battery, cables and terminals, making it easy for an automobilist to install the equipment on a car, and an accommodation base is also provided, so that those who are now using Remy equipment may use the new lighting type in place of the old ignition magneto. The strength of the permanent magnets of the magneto is maintained by means of a field winding, so that the flux density of the magnetic force is greater than it is in magnetos in general. It is on this account that it is not necessary to run the magneto at such high speed that it would become noisy and heat up owing to hysteresis effects in the armature core. This equipment is showing at Chicago, in the commercial section, for the first time.



Illustrating the new Remy combination ignition and lighting equipment

Coming Events

CATALOGUE OF FUTURE HAPPENINGS IN THE AUTOMOBILE WORLD THAT WILL HELP THE READER KEEP HIS DATES STRAIGHT—SHOWS, ANNUAL MEETINGS AND OTHER FIXTURES

Feb. 6-11.........Chicago Coliseum, Tenth National Automobile Show Under the Auspices of the National Association of Automobile Manufacturers, Inc., Commercial Vehicles, Pleasure Cars, Motorcycles and Accessories.

Feb. 6-11.........Buffalo, N. Y., Ninth Annual Show, Automobile Trade Association of Buffalo, Broadway Arsenal.

Feb. 7-11.........Worcester, Mass., Annual Show, Licensed Automobile Dealers Association of Worcester.

Feb. 9-11.........Davenport, Iowa, Second Annual Show, Davenport Automobile Club.

Feb. 13-18........Washington, D. C., Annual Show, Convention Hall.

Feb. 13-18........St. Louis, Mo., Fifth Annual Show, Coliseum.

Feb. 13-18........Winnipeg, Man., First Annual Show, Winnipeg Motor Trades Association.

Feb. 13-19........Kansas City, Mo., Annual Show, Motor Car Trade Association.

Feb. 14-19........Dayton, O., Second Annual Show, Memorial Building.

Feb. 15-18........Grand Rapids, Mich., Annual Show.

Feb. 18-25........Minneapolis, Minn., Annual Show, Minneapolis Automobile Show Association, National Guard Armory.

Feb. 18-25........Brooklyn, N. Y., Annual Show, Brooklyn Motor Vehicle Dealers' Association, 23d Regt. Armory.

Feb. 18-25........Binghamton, N. Y., Second Annual Show, Binghamton Automobile Club and Chamber of Commerce, State Armory.

Feb. 18-25........Newark, N. J., Fourth Annual Show, New Jersey Automobile Exhibition Co.

Feb. 18-25........Albany, N. Y., Annual Show, Albany Automobile Association, State Armory.

Feb. 18-Mar. 4....Cleveland, O., Annual Show, Cleveland Automobile Show Company.

Feb. 20-25........Cincinnati, O., Annual Show, Cincinnati Automobile Dealers' Association.

Feb. 20-25........Portland, Me., Sixth Annual Show, Auditorium.

Feb. 20-26........Omaha, Neb., Annual Show, Omaha Automobile Association.

Feb. 20-25........Hartford, Conn., Fourth Annual Show, Hartford Automobile Dealers' Association, Foot Guards Armory.

Feb. 21-25........Baltimore, Md., Annual Show, Automobile Club of Maryland, Fifth Regiment Armory.

Feb. 24-27........New Orleans, La., Annual Show, New Orleans Automobile Club.

Feb. 25-Mar. 4...Toronto, Ont., Automobile Show, Ontario Motor League.

Feb. 25-Mar. 4...Kansas City, Mo., Fifth Annual Show, Kansas City Automobile Dealers' Association, Convention Hall.

Feb. 25-Mar. 4....Harrisburg, Pa., Second Annual Show, Automobile Dealers' Association of Harrisburg, Third Street Car Barns.

Feb. 28-Mar. 4...Sioux City, Iowa, Second Annual Show, Sioux City Automobile Dealers' Association, Auditorium.

Mar. 4-11........Boston, Mechanics' Building, Ninth Annual Show, Licensed Automobile Dealers' Association.

Mar. 4-11........San Francisco, Cal., Annual Show, San Francisco Motor Club.

Mar. 7-11........Des Moines, Ia., Third Annual Show, Des Moines Automobile Dealers' Association, Coliseum.

Mar. 14-18.......Syracuse, N. Y., Third Annual Show, Syracuse Automobile Dealers' Association, State Armory.

Mar. 14-18.......Denver, Col., Annual Automobile Show, Management Motor Field, Colorado Auditorium.

Mar. 15-18.......Louisville, Ky., Annual Show, Louisville Automobile Dealers' Association, First Regiment Armory.

Mar. 18-25.......Pittsburg, Annual Show, Pittsburg Auto Show Association (Inc.), Exposition Hall.

Mar. 25-Apr. 1...Buffalo, N. Y., Fourth Power Boat and Sportsmen's Show, Sixty-fifth Regiment Arsenal, Buffalo Launch Club.

Mar. 25-Apr. 8...Pittsburg, Fifth Annual Show, Duquesne Garden, First Week, Pleasure Cars; Second Week, Commercial Trucks. Automobile Dealers' Association of Pittsburg, Inc.

Apr. 1-8..........Montreal, Can., Automobile and Motor Boat Show, Automobile and Aero Club of Canada.

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RECIPROCITY between the United States and Canada is the subject of pending official action on the part of two great governments, which goes to show that war makes boundary lines and trade erases them. The automobile industry is taking a prominent part, and its influence in favor of reciprocity is being felt at the present time to a far greater extent than the average man is likely to appreciate. Buffalo is the scene of a great automobile show, and it is the home of a large and prosperous automobile manufacturing industry, with plants covering every phase of the work and facilities that are second to none. Buffalo is at the gateway which leads from a great republic to a masterly dominion, and intercourse between the citizens on either side of the line has long since beaten a path between Buffalo and the great business centers of Canada. At the Buffalo show this year the Canadian dealers in automobiles are in force, and they represent a strong situation. There is one point in relation to Canada that should be emphasized, and it has to do with the quality of the automobiles that are preferred on the other side of the line. Those who have tried to capture the Canadian market have found that it is a very simple and pleasant undertaking if the automobiles offered are positively good and if the makers behind them are responsible. The Canadian representatives of the automobile trade are visitors at Buffalo this year to so great an extent that they represent a conspicuous portion of the attendance, and the reason why they are present is because American-made automobiles are up to the high standard of Canada's buying public. As far as the automobile is concerned it is the advance guard of reciprocity, and its position is so strong that it crosses the line as if it were the door of a friend's domicile.

* * *

MERCHANTS are attending the second section of the Chicago automobile show in person. They consider that the freight automobile situation is so important to them that it can no longer be delegated to assistants, and the whole automobile fraternity is agog with expectancy, for, as one great captain of the industry said: "We have been ambushed." For a number of years it has been the feeling that freight automobiles were not looked upon enthusiastically by the users of horse-drawn vehicles, and even a few months ago those who favored the building of freight automobiles were a little chary about making large investments, out of fear that the old inertia might still hang on the trail of success. The time is past when anyone will seriously debate on the side of the horse from a commercial point of view, and the real question is, How shall freight automobiles be employed to realize the highest efficiency? But this is a problem that has not been entirely solved and it offers opportunity to the educators of the industry to school themselves fittingly with the hope, perchance, that they will then be able to impart sound information to others. In the meantime the best indication is that the freight automobile situation will demand the use of heavy trucks for the primary delivery, medium-sized trucks for the intermediate transportation of goods, and light delivery wagons in the final distribution of the merchandise, with provision for the quick transfer of goods from the heavy trucks to the trucks of intermediate delivery, and a further means by which the light delivery wagons may be brought into nimble play.

* * *

IN dealing with the spark-plug question in THE AUTOMOBILE of this week, light is thrown upon a serious phase of the problem. It would seem that a magneto, however good it may be in the abstract, cannot perform any better than is indicated by the quality of the spark-plug that is placed in the combustion chamber of the cylinder of the motor for the purpose of delivering the spark to the gas to be ignited. While magneto builders have been busy improving their product until to-day it rests upon the pinnacle of human endeavor along this line of activity, the makers of spark-plugs have been trying to find out how they could compete with each other, partly by increasing quantity in order to lower "overhead" costs, and, for the rest, by doing work at a terrific rate of speed, with the result that some of it is marred by imperfections. The owner of an automobile costing anywhere from $500 to $5,000, who expresses a preference for a poor spark-plug, which is all that he can hope to obtain for 21 cents, more or less, is having his investment of from $500 to $5,000 vitiated by this display of parsimony on his part, and the wise course for him is to go in quest of $5 spark-plugs, if he can find them, for, in all truth, the motor, magneto, and, in fine, the investment represented will prove to be as good as the spark-plug.

Jersey Senate Defeats Reciprocity Measure

TRENTON, N. J., Feb. 6—The Edge bill, providing for reciprocity for New Jersey with those States that extend the privilege of the roads to residents of this State, was defeated in the Senate to-day by a vote of 11 to 8. There were two absentees, both of whom are known to have been favorable to the Edge bill, but even if they had been present the measure would have lacked one vote of enough to pass it.

There is said to be a single glimmering chance that the bill may be reconsidered, and Senator Edge provided for that contingency by changing his own vote at the last minute so that he might be able to move a reconsideration if such action should seem advisable.

While the lower house is known to be strongly in favor of remedial legislation covering automobile regulation, it is not believed that a reciprocal law can be passed at this session under any circumstances.

The situation in Jersey is distinctly strained, as the motorists who reside in the State are cut off from touring in other States without payment of license in precisely the same measure as those of other States are forbidden to tour in Jersey without paying the State dues.

The point was made by Senator Edge in his argument for the bill that if the State was thrown open to automobilists under certain limitations a vastly enlarged patronage of the State would result.

The opposition pointed out that the roads would be filled with wealthy tourists who would scurry hither and thither and scare horses and residents by their presence.

Senator Edge was disposed to agree and declared that it would be difficult to convince a Jersey business man, hotelkeeper or merchant that such a condition would prove disadvantageous, and said that as far as scaring the residents was concerned he had never noticed any tendency toward nervousness on the part of his fellow-citizens as a result of automobiling.

British Capital in Studebaker Corporation

While motordom has been expecting the announcement for some time, the actual news of the financing of the Studebaker Corporation last week caused more than a ripple on the surface of the automobile industry. Even the news that was placed before the public was not full and complete in its details, for the reason that there still remains considerable to do before the plans may be said to be perfected.

As far as they have been outlined, the plans are for a giant corporation having a capitalization of $45,000,000, divided into $30,000,000 of common and $15,000,000 of seven per cent. cumulative preferred. Of this latter issue, the definite announcement has been made that $13,500,000 has been sold to Kleinwort Sons and Co. of London in association with Lehman Brothers of New York.

When the new corporation is formally chartered it will take over the wagon works of Studebaker Brothers at South Bend, Indiana, and the E-M-F Co. of Detroit. Through tenure of the common stock, it is announced that control of the big corporation will remain with the Studebakers, but the financial interests that have been brought into the company will have an active voice in the management.

The proceeds of the sale to the British bankers and their associates will be used to take up the E-M-F plant and to liquidate the bonded indebtedness of the constituent companies. The surplus will be used as working capital and for some major extensions that are in contemplation.

Under the financial plan, the retirement of the bonds of the various companies will advance the preferred stock issue to a position of first lien upon the property of the corporation. Announcement was made that the common stock shall pay no dividends until after a certain fixed amount of working capital has been accumulated.

To Reorganize A. L. A. M.

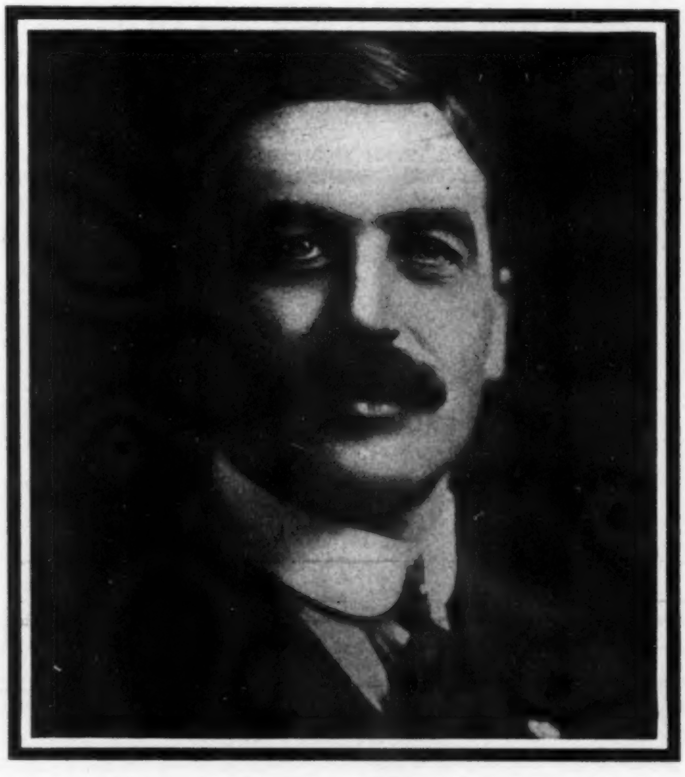
Following a meeting of the board of managers of the Association of Licensed Automobile Manufacturers in Chicago, with President Charles Clifton in the chair, almost 50 makers convened to discuss new plans that have been long in preparation.

It is expected that the new organization, when finally perfected, will include all the leading motor car builders of America.

The name, the final outline of the plan of incorporation and other details will be perfected by the following special committee, which will call another meeting within a short time: C. C. Hanch, of the Nordyke and Marmon Company; Hugh Chalmers, of the Chalmers Motor Company; H. B. Joy, Packard Motor Car Company; Charles Clifton, Pierce-Arrow Motor Car Company; Benjamin Briscoe, United States Motor Company, and Thomas Henderson, Winton Motor Carriage Company.

W. E. Metzger Heads N. A. A. M.

William E. Metzger, who has been vice-president of the National Association of Automobile Manufacturers, was chosen president of that organization at the annual meeting held during the first week of the Chicago show. Mr. Metzger is president of the Metzger Motor Car Company, of Detroit, makers of the Everitt "30" and the Hewitt truck. He succeeds L. H. Kittredge, of the Peerless company. The other officers selected were as follows: Benjamin Briscoe, first vice-president; H. O. Smith, second vice-president; S. T. Davis, Jr., third vice-president; Roy D. Chapin, secretary; W. R. Innes, treasurer.



W. E. Metzger, the new president of the N. A. A. M.

Worcester Show Held in Two Buildings

WORCESTER, MASS., Feb. 7.—The first show of the Worcester Automobile Dealers' Association was opened in the Auditorium here to-night with an annex or overflow show in the Franklin Square Garage nearby, and a brilliant display of models awaited the inspections of motor lovers of this city and Central Massachusetts, and it is estimated that from 2,500 to 3,000 people attended the opening. The Auditorium, where nearly 85 cars, every one a 1911 model, were on the floor, presented a scene that for beauty of decoration and display outclassed anything of its kind ever held in New England with but one exception, that of the Boston show; while the "overflow" show, in the Franklin Square Garage, in which some thirty more cars are displayed, also presents a beautiful sight.

The show is the largest venture in Worcester in the history of the automobile business, and no efforts have been spared by the members of the Dealers' Association to make it a grand success. If the attendance for the opening night is indication toward the goal of success, the show will surpass all expectations of those interested.

The exhibit in its entire scope, including the overflow show in the Franklin Square Garage, the foyer and the main floor of the Auditorium, where the visitors find on display cars ranging from the $6,000 Thomas limousine down to the small $600 Maxwell runabout, presents a beautiful sight. Electricity in its various forms is an important feature in the decorations, and as one enters the big hall through the main foyer an Italian scene presents itself, the visitor passing under a snow-white pergola with fluted columns and carved rafters. Pedestals and overhead structure is entwined with foliage and hundreds of electrically-lighted flowers, and to correspond with these the railings and panel sign posts are of the Italian style.

The exterior walls of the exhibition space are to a height of ten feet decorated with hand-painted scenery, and, as they completely encircle the Auditorium, it presents a wonderful view in perspective as well as making not only an exceedingly beautiful, but appropriate, background for the numerous models of cars on exhibit. An electric sign 20 by 25 feet, within a block of the Auditorium, points the way to motor lovers and strangers in Worcester who are bound for the show, and in all the show presents as fine and up-to-date a decorative scheme as has ever been seen in the most important shows held in any city this season.

Several of the best features of the Madison Square Garden show, including the Martha Washington coupe, are incorporated in the Worcester show, and to top matters off in the line of features an unique, novel and absolutely original program and handy book with details of the show and specifications of the different exhibits carefully noted, prepared by the committee in charge of the show and Manager Walter L. Weeden, are circulated freely to visitors. Friday night has been set aside by the management of the auto show for "Society Night," and an extra fine musical program has been arranged for that evening, with a number of prominent soloists contributing.

Fifty-five pleasure cars, six commercial cars, one racing car, one mountain wagon, four chassis, one engine and one power plant are exhibited at the show, besides various exhibits of the accessory and motor cycle dealers. The exhibitors and their exhibits are as follows:

Place Garage—One runabout, three touring cars and one torpedo-body Stoddard-Dayton.

H. J. Murch—Two touring and one torpedo-body Cadillacs.

B. A. Lemont—One runabout and two touring Elmore cars.

John S. Harrington—Two touring, one torpedo-body and one limousine Chalmers, and two touring and one limousine town car Thomas.

Worcester Motor Car Co.—One runabout and two touring Franklins and one touring Reo.

Macker-Tyler Co.—One runabout and one touring Winton; one touring and one mountain wagon Stanley; one runabout, one touring, three torpedo bodies and one coupe Overland; three Overland commercial cars.

White Motor Car Co.—Two touring, one torpedo and one limousine White gasoline, one White steamer and White commercial car.

Central Motor Mart—Two Garford commercial trucks.

Dawson Machine Co.—One runabout, one surrey body and two touring Mitchells.

Leroy Leighton—Two runabouts, two touring, one torpedo and one racing Hudson.

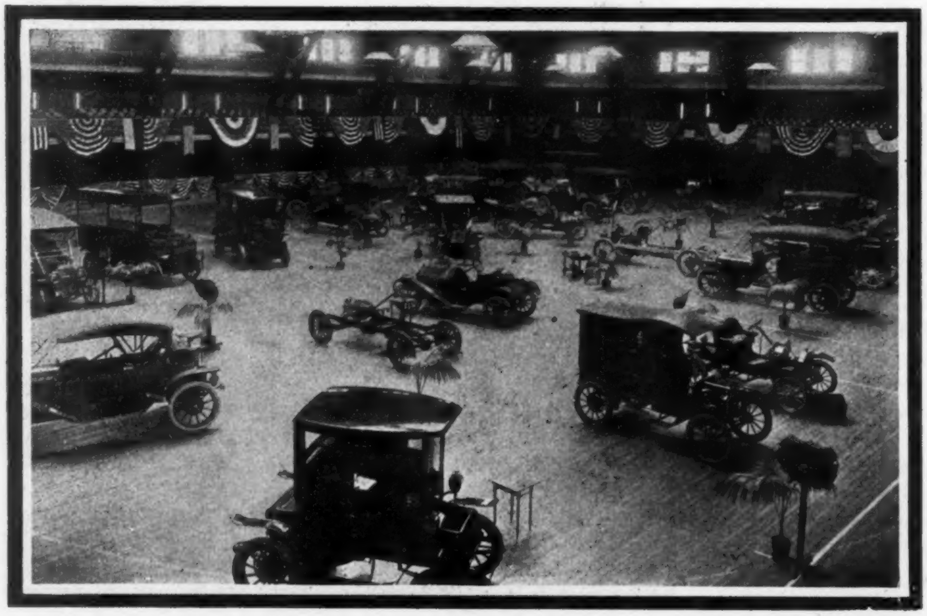
Franklin Square Garage—One touring Columbia, one runabout and one touring E. M. F., two runabouts and four touring Maxwells, Lozier Rambler and Brush.

The accessory firms represented are: Worcester Pressed Steel Company; A. G. Gay Co., oils; George F. Clark, motor cycles; Harvey Parker, accessories; Iver Johnson, accessories; *Automobile Journal* of Pawtucket; Alsten & Goulding, accessories; Post-Lester, accessories; E. A. Buck & Co., oils; Coe Wrench Company.

This is the first affair of this kind attempted in Worcester since 1907, when a few dealers merged their interests in an exhibition, and from the spirit of enthusiasm on the part of everybody connected with this year's show, there is no doubt but that the first annual show of the Worcester Automobile Dealers' Association will practically end Saturday night as one big, grand success.

Some interesting facts and leading points about the Worcester automobile show:

Motor car exhibitors	11
Accessory and motorcycle dealers	15
Pleasure car exhibits	55
Commercial cars	6
Different makes of cars	21
Value of exhibits	$175,000
Lowest price car at show	$600
Highest price car at show	$6,000
Exhibition space, square feet	18.000



The Hudson County (N. J.) Dealers' Show is well staged, with plenty of room and a fine array of exhibits

Hudson County Dealers Have Creditable Show

WITH the products of seventeen automobile factories included in the exhibits, the Hudson County Automobile Show on Saturday last opened its doors to the numerous visitors, residing mostly in that county. The show is being held at the Fourth Regiment Armory in Jersey City, and the building, which was not taken over by the show committee until 8 A. M. of February 4, was effectively decorated with flags and electric lights.

The show is being managed by O. D. Corbett, who arranged the Guttenberg races last fall, and who, in conjunction with the automobile dealers of Hudson County, feels confident of making the first show of this kind held in the county a success.

The well-known orchestra of Prof. J. B. Lane, of Hoboken, N. J., supplies the musical entertainment and an elaborate program is offered.

There will be a society night during the week, and the holding of an official night is also contemplated by the management. Hopes are being entertained that Governor Wilson of New Jersey and the mayors and officials of the county will attend the show.

The main hall of the armory, where the cars are exhibited, has an area of 180 by 135 feet, which is well filled by the automobiles shown, the list of which is given below.

Owing to the fact that the building could not be taken possession of before Saturday morning several exhibitors were unable to send in their cars in time to be at the show at the opening on Monday night.

Following is a list of the cars shown and the names of the exhibitors:

Premier and Reo—R. M. Owen & Co., Newark.
Correja—Correja Motor Car Co., Newark.
Haynes—Haynes Automobile Co., Newark.
Brush—John Moore & Co., New York City.
Penn "30"—Reynolds & Erwin, Newark.
Lexington--Lexington Motor Car Co., New York City.
Marion—Livingston Motor Car Co., Bayonne, N. J.
Grabowsky 1-ton truck—Commercial Maintenance and Motor Co., Newark.
Paterson—O'Neil Motor Car Co., Newark.
Autocar 1 1-2-ton truck and ambulance—Autocar Co., New York City.
Oldsmobile, E-M-F, Flanders—Clinton Auto & Garage Co., Jersey City and West Hoboken.
National—Union Auto Co., Union Hill, N. J.
Hudson, Chalmers and Morgan truck—Hudson Motor & Garage Co., Hoboken.

The exhibitors of the National car also display several trophies won in various Jersey contests during the last year or two. They also show the Howard Demountable Rim, made at Trenton, N. J., and the demonstrator does the work of both demounting and remounting in little more than a minute's time.

Pittsburg Preparations

PITTSBURG, Feb. 6—Preparations for the two big Pittsburg shows are going forward rapidly. A big force of decorators and electricians is busy at Duquesne Garden getting ready. The entire ceiling of the Garden will be covered, and the illumination will be more gorgeous than ever before.

The exhibition of motor trucks promises to be one of the biggest features of this show.

The Pittsburg Automobile Show Association is working overtime to get the Expositon Show in first-class shape by the opening day, Mar. 18. The show will occupy the entire Exposition Building, which measures 330 x 130 feet. There will be 1,000 feet of continuous paintings 18 feet high to screen the booths. The show colors will be red, white and gold. Two or more aeroplanes will hang from various parts of the ceiling.

Show Manager Thomas I. Cochran reports that nearly all show space has been applied for. Last week E. E. Gregg, of the Pennsylvania Motor Car Co., and Elias Lange, of the Lange Wagon Co., were added to the show directory.

Davenport Has Interesting Show

DAVENPORT, Iowa, Feb. 6—The Davenport Automobile Club's second annual show opens Thursday in the Coliseum. There will be cars on display with a total value of $75,000, and the interior of the hall will be decorated with a central Colonial colonade of white and green. Friday, Feb. 10, will be the big musical day, and the military band will play a special program, accompanying selected soloists.

There will be fourteen exhibits with an average of three cars each. The show will include special models that have graced the Chicago and New York shows, and later will appear in Minneapolis and other Middle Western centers.

Velie Considers Truck Making

MOLINE, Ill., Feb. 6—According to the unofficial, but generally considered authentic sources, the Velie Motor Co. will begin in the near future the manufacture of motor trucks.

Vulcan Hails From Detroit

In describing the Vulcan freight automobile on page 122 of THE AUTOMOBILE of January 12 the address of the Vulcan Motor Car Company was given as Chicago, Ill. The home office of the company is at Detroit, Mich.

Interior of the Fourth Regiment Armory, where the dealers of Hudson County, N. J., are holding their annual show

ACCESSORIES

POSITIVE LOCK GREASE CUP

Parts of the car that are lubricated by grease through the agency of grease cups are liable to suffer if the grease cup should part company with the member to which it is attached. Provided the shank is a good fit and the threads are not worn, vibration should not jolt it out of its hole, but the part that is more liable to be lost is the screw-down top; in other words, the grease retainer. In the Tucker grease cup this cannot happen, as the small cap acts as a positive lock, and until this has been depressed the cup portion C1 cannot turn. Fig. 1 shows the inside of the cup, S2 being a bridge with a square hole cut in it. The hole receives a square pin S1, and herein lies the locking action. Inside the cap in Fig. 1 there is a catch that holds

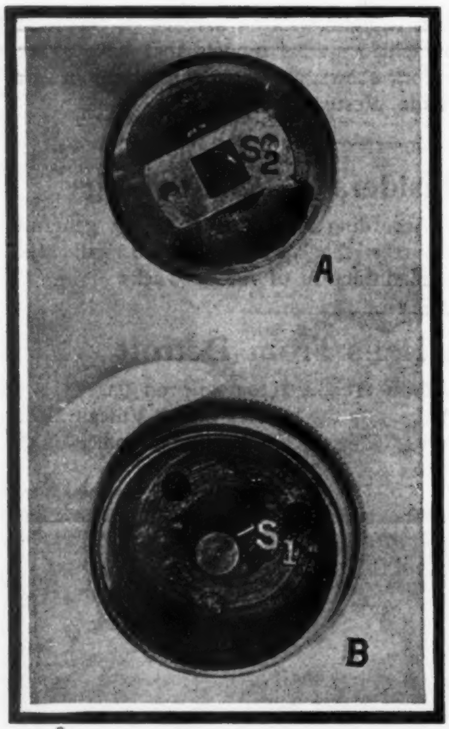


Fig. 1—Showing inside of Tucker positive lock grease cup

the extension of the pin S1 a prisoner unless the cap A1 (Fig. 3) is pressed down, and as the cap is held out by a spring there is no possibility of the cup C1 turning with vibration. To unlock the cap C1 push small cap A1 down and turn to the right. It will lock in this position and the cap C1 can be turned as much as required. To relock give cap A1 one-quarter turn. To unscrew simply turn cap one-half turn to the left after pressing it down. This cup is made by W. W. & C. F. Tucker, Hartford, Conn.

EXTRACTING WATER FROM GASOLINE

Foreign matter in the gasoline tank may result in the autoist having to dismantle his carbureter on the road, and cases have been known where the water has formed a stoppage in the feed pipes and frozen. The Cresco tube, made by the Cresco La-

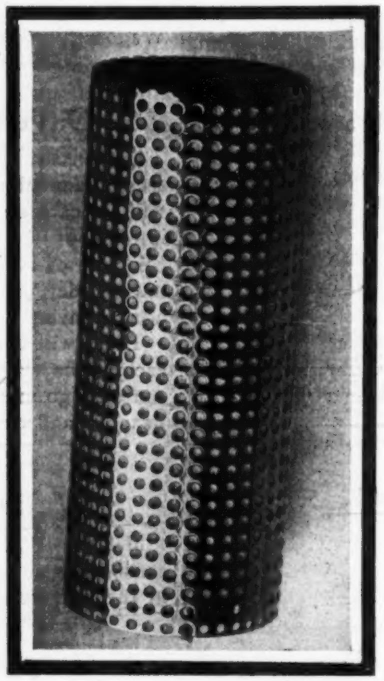


Fig. 2—Tube for absorbing water from gasoline tanks

boratory, New Haven, Conn., and illustrated in Fig. 2, is intended to overcome this. Dropped into a tank one of these devices will absorb about six ounces of water.

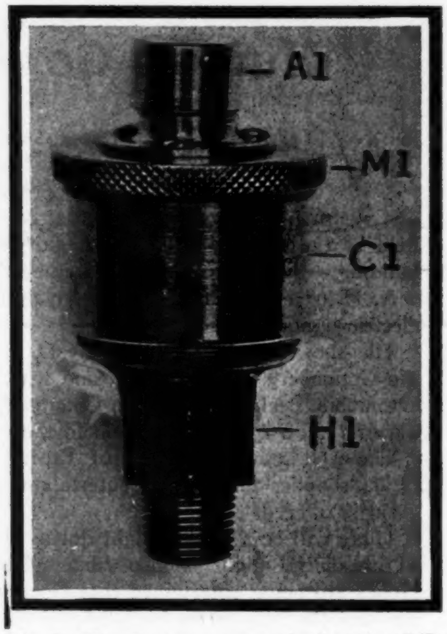


Fig. 3—Showing arrangement of parts of the Tucker grease cup

WARNER UNIT POWER PLANT

In Fig. 4 is illustrated one of the three sizes of unit power plant which the Warner Mfg. Co., of Toledo, Ohio, is offering to the 1912 trade. Among its features are long stroke, medium bore, large valves arranged on both sides of the cylinder, valve springs enclosed making them oiltight and reducing noise to the minimum; either twin or block cylinders T-head, thermo-syphon and the crank case machined so that a water pump can be installed later should customer desire; rear timing gears which are enclosed in the flywheel housing. The outfit can be furnished with either cone or disc clutch, three speed, forward and reverse, selective sliding transmission gears, caged thrust bearings on throw-out yoke, oil pump with constant level further arranged so that glass can be placed on the dash of the automobile.

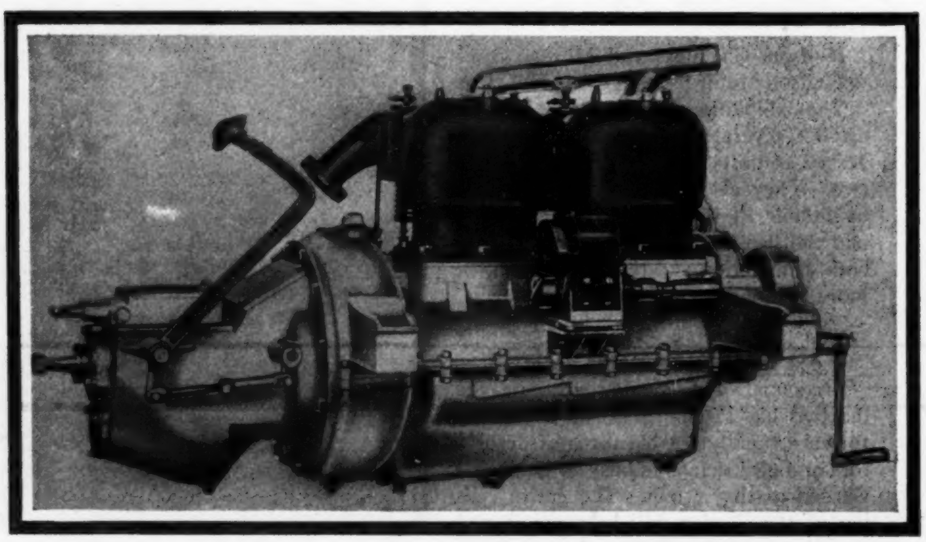


Fig. 4—The Warner 16-30-horsepower unit power plant